AUTOMOTIVE INDUSTRIES
The Automobile

Reg. U. S. Pat. Off.

Volume 67 — Number 12

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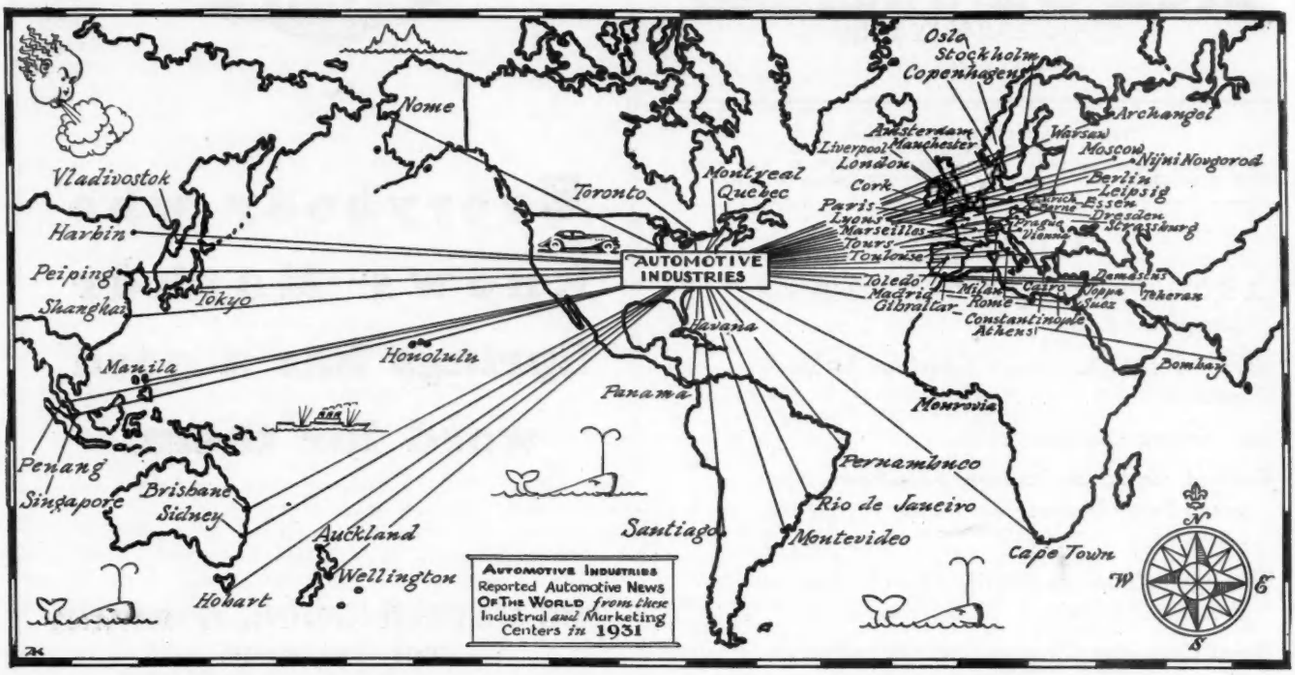

News of the *automotive world* is printed weekly in *Automotive Industries*

Automobiles are made and sold in London, Paris, Singapore; all over the world. Detroit is the greatest of the world's automotive manufacturing centers but it is not the *only* one. Each of the others is important in the territory it serves.

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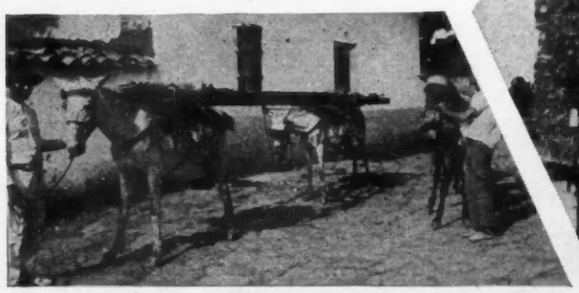
U. S. Leads World Exports Despite Tariffs and Slump

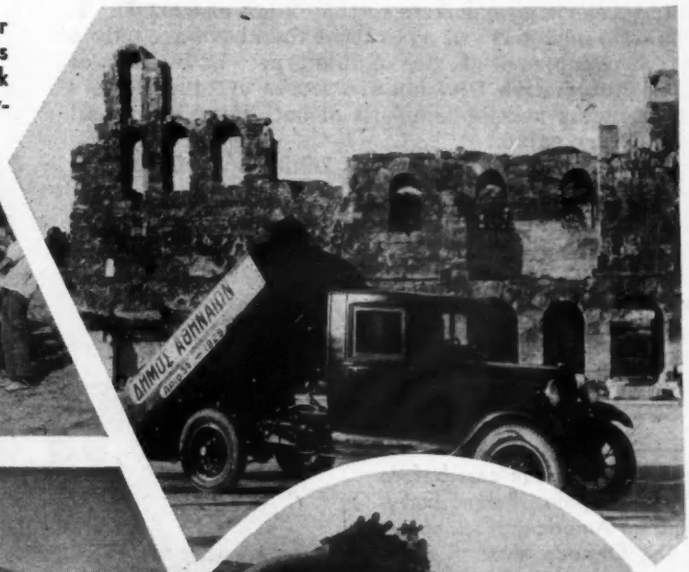
by A. W. Childs
Chief, Automotive Division
Bureau of Foreign and Domestic Commerce

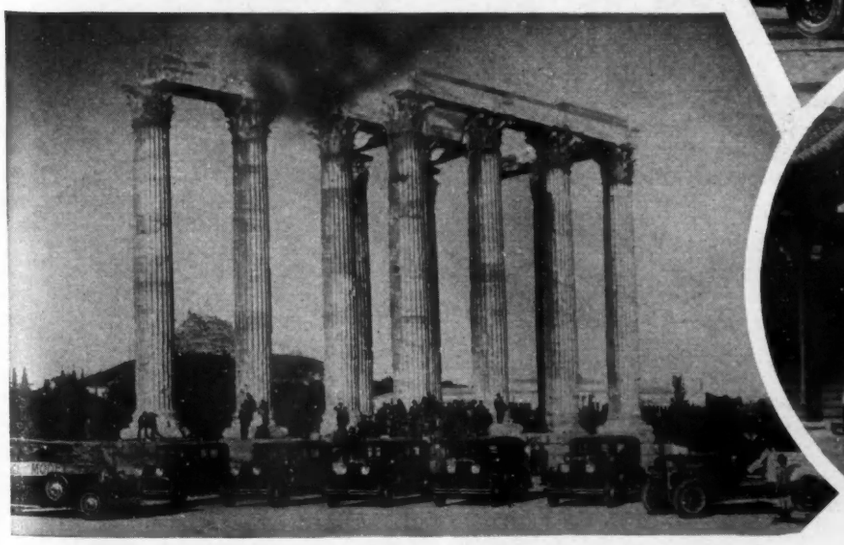
VIEWED from any angle, a sale which totals $108,000,000 is nice business. That is the order placed with and delivered by American manufacturers of automotive products to purchasers outside the United States during the fiscal year ended June 30, 1932. To be sure, it is a much smaller order than was received in some past years, but the figure is still sufficiently large to have a vital influence on manufacturing, employment and wages paid in this country, and is a rather effective answer to those who would abandon our attempts to supply a large share of the products needed by the peoples of the

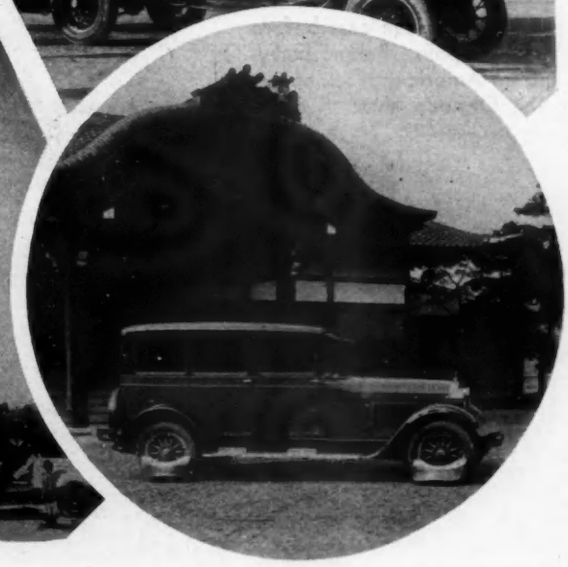
108 million dollars of American automotive products shipped to Ports of Seven Seas in 12 months

Below: Transporting U. S. truck and parts over Chilean Andes. Lower left: Shipment of cars and trucks unloaded in front of ancient Greek temple. Lower right: An American car delivered to a Prince of Japan









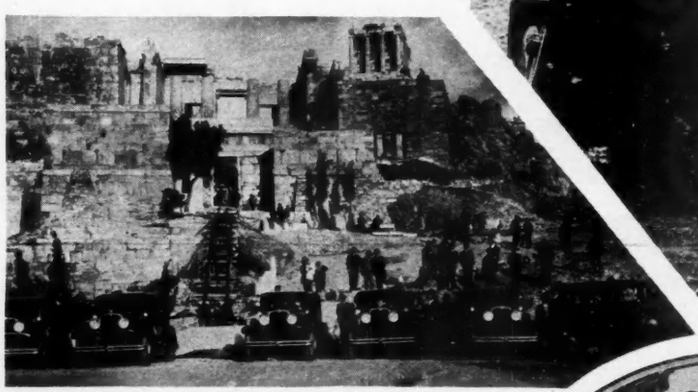
world—products which we can produce to best advantage. Speaking of general world trade, it is also well to remember that during the last calendar year the export business of the United States was greater than that of any other country.

Despite unfavorable selling conditions in many world markets, rendering difficult the efforts of the Automotive Division in connection with its direct trade-promotional activities, foreign agents or dealers for American automotive products are still being found. During the past fiscal year scores of such sales outlets were lined up through the persistent efforts of the Bureau's Commercial Attaches and Trade Commissioners located in the commercial centers of the world. Typical examples of this type of service are the closing of: (1) an automobile agency in Scandinavia, resulting in an initial order for 25 cars, (2) a dealership for trucks in the Far East, producing an order for 12 vehicles, and (3) an agency in the Near East for spark plugs, with an initial order of 1200. A typical "depression" service was the adjustment by a foreign office of difficulties arising from liquidation of an importing company. Matters were so arranged that about $30,000 worth of automotive parts was taken over by other companies with practically no loss to the interested American manufacturers. Another somewhat similar service, in connection with outstanding claims and collections, was the service by one Bureau foreign representative, the use of whose good offices, during only a part of the fiscal year, resulted in amicable settlement of outstanding bills due American exporters to the extent of $29,000. It must be emphasized again that the above are only a few examples of service of this type. In the files of the Automotive Division are scores of other letters evidencing accomplishments of both large and small monetary value.

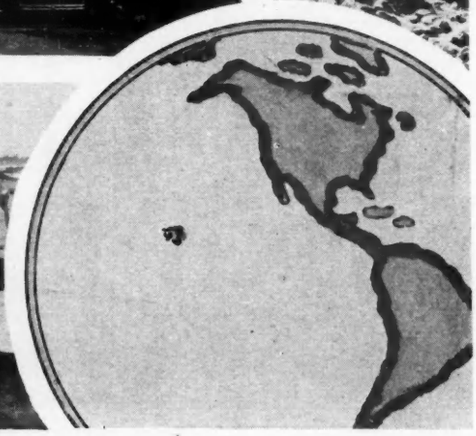
Of course the Automotive Division performs annually thousands of services whose value is intangible and cannot be given a monetary value. Included among these are the furnishing of frequent periodic market reports, basic and current data on all foreign countries, replies to specific inquiries, settlement of trade disputes and the like. But the concrete results of its direct trade promotional services, by which a connection is arranged between the American and the foreign firm, and sales of goods actually made, can be more definitely appraised.

The Automotive Division's separate and distinct services to industry, combined with those of the Bureau's district offices in the United States, totaled 245,289 during the fiscal year. It is obvious that, due to lowered purchasing power in foreign countries, there were less requests for certain types of services, but those arising as a direct result of the depression abroad have increased greatly. This is due in no small measure to the fact that our foreign offices, aside from their usual functions, must now "pinch-hit" for a great many resident or traveling factory representatives who have been withdrawn in recent years. This, of course, results in a greater demand for services which would normally have been performed, at no small cost, by the latter, and many firms have expressed their greater

Below: An American truck hauling an ancient Brazilian ox cart to a museum



Right: American cars before the Acropolis. Below: Ferrying an American truck across the Orinoco river, Bolivia



dependence on the Bureau because of this reason.

In an earlier issue (March 28, 1931) of *Automotive Industries*, the writer outlined and discussed in detail the various routine functions and services made available by the Division to American industry, and reprints of that story are available upon request. It might be well to repeat here, however, that the Automotive Division is essentally a fact-finding unit of the Bureau of Foreign and Domestic Commerce, organized 11 years ago to foster, promote and develop American trade. It concerns itself chiefly with the collection and dissemination of information relating to foreign automotive markets and with the investigation of certain phases of domestic commerce. Other than the Bureau's Washington headquarters, it has a number of domestic and foreign offices in order that American exporters may have constant direct contact with the Bureau, and, through it, with foreign importers. Considerable assistance is given American firms by means of agency work described above, monthly market surveys of foreign countries, data concerning nature of competition, and methods of meeting it, sources of supply of raw materials, tariffs and customs regulations, shipping and financing, important trends and shifts in markets, statistics of all types, and a great many other related subjects which must be considered in developing a foreign sales program.

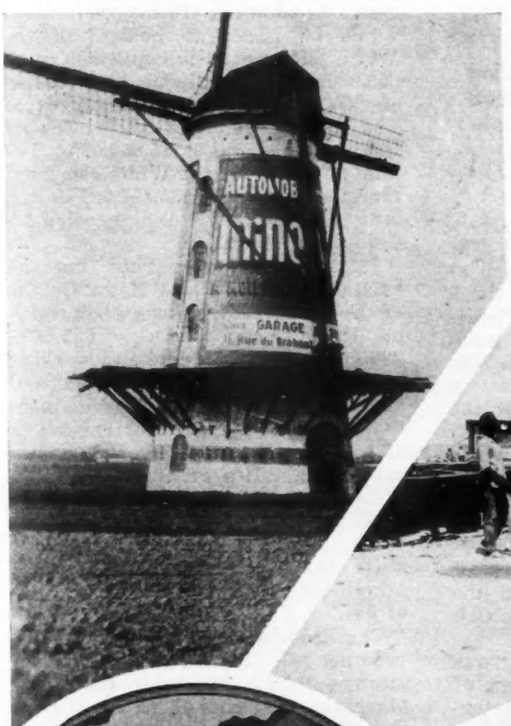
Six Automotive Trade Commissioners who cover Europe, the Near East, South Africa, India and South America devote the major portion of their effort to promotion of trade in automotive lines. In addition to these officers, the Bureau has general representatives in all of the world's leading commercial centers. While the latter offices handle all commodities, the Division feels that through its educational activities it has a fairly well-trained automotive man in every foreign office.

In accordance with a plan to promote the automotive education of foreign representatives of the Federal Government, the Automotive Division has kept its ear to the ground to note all important developments which might tend to offer increased opportunity in foreign markets. During the year the Division has distributed a number of special bulletins to our own and the Consular Service which developed ideas to guide these officials in their present and future efforts to increase our possible share of the world's automotive trade. All of this has been done to enable these representatives, without in any way relaxing other efforts, to concentrate their trade-promotion activities on the lines and in the directions which seem to offer the best relative possibilities now and when the world begins to buy again on a volume basis.

One of such bulletins, which finally resulted in a world study, had to do with the market for parts, accessories and garage and service equipment. A study of export figures, together with the knowledge

(Turn to page 380, please)

Below: An automobile advertisement painted on a Belgian windmill



Left: "Assembly line" for U. S. cars on the beach at Port-au-Prince, Haiti. Below: Motor vehicles have found a ready market in Ceylon

Studebaker-White Merger Submitted to Stockholders

Action Subject to Approval of Three-Fourths of White Motor Co. Stock on or Before Oct. 13

A. R. Erskine, who, according to White directors, will head merged company

NEW YORK, Sept. 14—Plans for acquisition of the White Motor Co., Cleveland, by the Studebaker Corp., South Bend, Ind., were announced yesterday in a statement signed by A. R. Erskine, president of the latter, and R. W. Woodruff, chairman of the board of directors of the former company. Their statement was issued after the directors of White Motor had met here and those of Studebaker had met in South Bend.

The consolidation, which is subject to ratification by the stockholders of each company by Oct. 13, would be the largest effected in the automobile industry in several years, uniting companies with combined assets of more than $85,000,000, after substantial writedowns. At the end of 1931 Studebaker had assets carried at $118,286,448, including current assets of more than $30,000,000, while White had total assets of $42,778,056, including current assets of $23,460,166.

Albert R. Erskine will be head of the Studebaker-White interests, with Frederick S. Fish, Studebaker chairman, as chairman of the merged company, it was indicated by directors of the White company following their meeting here.

A statement issued by the directors read, in part:

"The merging of these companies is prompted by advantages in the purchases of materials and by enlarged and intensified distribution. The identity of the White organization as an operating unit will be maintained, as will be the Studebaker, Pierce-Arrow and Rockne units. The present White stockholders will have representation on the board of directors and the executive committee of the Studebaker Corporation. Studebaker will also be represented on the White Motor Company board.

"The terms of the plan, approved by the directors of both companies, are subject to the approval of three-fourths of the outstanding stock of the White Motor Company and the deposit of this stock on or before Oct. 13, 1932.

"The Studebaker Corporation was formed in 1911, as a development of the Studebaker Brothers Manufacturing Company, which began building vehicles in 1852. It has been a leader in the manufacture of automobiles since its organization and in 1928 purchased control of the Pierce-Arrow Motor Car Company. In 1931 it entered the small car market with the Rockne. White began in 1901 to make the White steamer passenger car and in later years the White gasoline passenger car. It ceased manufacturing passenger cars in 1917 and since that date has concentrated in the production of trucks and buses."

The terms for the merger provide for the payment by the Studebaker Corp. of $5 in cash, $25 in Studebaker 6 per cent two-year gold notes and one share of Studebaker common stock for each share of outstanding stock of the White Motor Co.

The notes are payable on or before two years from the date of the merger, but the Studebaker Corp. may, at its option, during the first year, substitute eight-year notes, exchangeable into the common capital stock of the Studebaker Corp., at any time during the eight-year period, on the basis of one share of Studebaker for each $25 of the principal of the note.

Since there were outstanding at the end of 1931, 650,000 shares of capital stock of the White Motor Co., the deal would cost Studebaker $3,250,000 in cash. In addition, $16,250,000 in notes would be issued to holders of the White Motors stock, together with 650,000 shares of Studebaker common stock, which closed yesterday at 9. The market value of this block of Studebaker shares is $5,850,000. The total payment for the White company, therefore, would be $25,450,000 on the basis of yesterday's closing price for Studebaker stock.

It is interesting to note that the balance sheet of White Motor Co., as of Dec. 31, 1931, shows book value applicable to capital stock of $35,580,296. On the same date net working capital was $22,107,092. Cash and government securities totaled more than $9,500,000. Total current assets of the White were $23,460,166 against current liabilities of $1,353,074.

Each share of White stock would be exchanged for cash, notes and securities amounting to $39. The White stock closed yesterday at 23⅜, against a high for the year of 25¾ and a low of 6⅞.

The Studebaker Corp. reported last year net sales of $64,406,858, and net income of $447,928, after taxes and other charges, equivalent to $7.11 a share on 63,000 shares of preferred stock. The common dividend was passed last June.

The White company's sales last year were $23,517,461. It reported a deficit of $3,234,956 for 1931 before the payment of dividends. Disbursements on the common stock were omitted after the first quarter of last year.

Estimated Sales, Studebaker and White Trucks*

	1928	1929	1930	1931
Studebaker ..	1,000	1,700	1,600	3,500
White	6,300	6,100	6,400	2,600

* Exclusive of buses.

JUST AMONG OURSELVES

Rumors, at Least, Reach New High

JUST returned this morning from a trip to Cleveland, Akron, Detroit and points West.

The automobile business is fast getting back to normalcy in one respect at least. The downward trend in sales seems to have been curbed, although nobody is expecting anything important in the way of an upward trend before 1933. But production of rumors is going up rapidly, if it has not already reached its previous high point.

The depression has been so bad, you know, that it has been hard even to get a good crop of rumors for the last year or so. But not today. One's ears aren't large enough to gather in all the gossip that is running wildly about from company to company and from mouth to mouth.

Investigation has convinced us that about 10 per cent of what one hears along the byways of the industry is almost true. The other 90 per cent just furnishes excitement for some, provides a vent for spite on the part of others, and represents, in still other instances, the expression of a hoped for condition.

Some of the rumors are too silly even to warrant denial. Some of them have gained such widespread circulation, however, that they have to be talked about.

Dame Rumor Biffs Pontiac and Olds

TAKE the one about the Pontiac and Oldsmobile lines. These two lines, Dame Gossip has been repeating, are to be discontinued.

After a bit of rather direct questioning in what we consider unimpeachable sources, we are ready to state that neither of these two lines will be discontinued and that both of them will be in the picture in very potent fashion again next year—and the year after that . . .

In fact we stand to obtain, not only the finest dinner Detroit can provide, but also a handsome new automobile free, from one of the Corporation's most powerful and most truthful executives if the aforesaid prophecy should prove untrue. We are certain that we will not collect.

Balance Sheet Spikes This One

ONE can hear, too, of the impending receivership of a company whose cash and negotiable securities exceed its liabilities about 13 to 1 at the end of a bad depression year.

We won't name the company because the rumor is silly. Some other big passenger car maker is thinking of liquidating, vicious gossips report; another is to discontinue some of its lines . . . and so on and so on *ad infinitum.*

The Battle's On— No Truces Seen

THROUGHOUT the galaxy of idle conversation run plenty of talk about mergers, combinations and changes in stock control of various companies.

We would be surprised if some changes in control in some passenger car companies did not materialize within the next six months—and we would be surprised also if there weren't some mergers in the passenger car field within 12 months after business has started definitely on the upgrade.

But we are certain that only 10 per cent of the combinations now rumored will ever take place. Rather, we look for a glorious battle for supremacy between the large and middle-sized companies now in the field.

Most of the independents, we think, will elect to try the experiment of increasing their lines, consolidating and expanding their marketing organizations and battling for permanently individual places in the automotive picture before they turn to merging and combining.

1933 Will See Results Of Genuine Pioneering

AS regards new models, 1933 is going to see some striking and important moves from the standpoint of both price and design.

More than ever before, we think, 1933 will mark a cleavage between those who choose to stick to the conservative path and those which step out with new things, mechanically and in appearance.

And the cleavage will not be between large and small companies, either.

Some real appearance changes are scheduled by some big manufacturers who have been relatively quite conservative in the last three or four years. Some of those who have been conservative in the past are planning to continue along that line—definite improvements, but no marked pioneering.

So far as we could find out, however, none of those who have been pioneering are planning to give up their movements in that direction.—N. G. S.

Demand for Space Economy May Revive C

Advantages of pioneer powerplant seen by engineers faced with demand for multi-cylinder engines and more payload capacity for freight and passengers

MOST of the earlier automobile and commercial vehicle engines were of the horizontal type. One of the reasons for this evidently was that internal combustion engines for stationary purposes had been developed chiefly as horizontal engines, and the method of crankshaft lubrication employed was best suited to that type. In passenger car practice the horizontal engine was discarded at an early date, but in the truck field it maintained itself to a certain extent until about a decade ago. The chief reason for the abandonment of the horizontal engine in the passenger car field was that it could not be conveniently accommodated under a hood at the front of the chassis. It called for a wide and low hood, which would have resulted in a much less attractive appearance of the car as a whole than the high and narrow hood that goes with the conventional vertical engine. Moreover, the splash system of lubrication, which was in almost universal use at the time the horizontal opposed engine was discarded in passenger car practice, was unsuitable for this type of engine, since it made it practically impossible to lubricate both banks of cylinders equally. The "distribution problem" also involved greater difficulties; that is to say, the connections to inlet ports, exhaust ports, cylinder jackets and spark plugs necessarily are more complicated when the cylinders are arranged in two banks on opposite sides of a crankcase than when they are in a single bank on top of the case.

The foregoing is an outline of the reasons why the horizontal opposed type of engine was abandoned at a relatively early stage in automobile development. The engine, of course, possesses certain advantageous features, for if it did not it never would have been introduced. There is also the possibility that the relative importance of its strong and weak points has been changed by the progress of automobile engineering and concurrent changes in the demands on automotive powerplants. Quite recently this type of engine has been carefully studied by bus and truck engineers with respect to its advantages for commercial vehicles under present-day conditions. The designers of such vehicles for a long time have aimed at the highest possible utilization of chassis space. If in the body of a bus of a given length of wheelbase, room can be made for two or more additional passengers, then the bus certainly possesses greater earning power and is of greater value to the operator. Much the same reasoning applies to trucks, especially in view of the inclination of state legislators to reduce the limits on the overall dimensions of commercial vehicles.

The trend toward a better utilization of chassis space has been emphasized by the introduction of so-called street car type buses by several firms and the growing practice (especially abroad) of locating the driver's seat either over or alongside of the engine compartment. The movement has been accelerated no doubt by the demand for increased power and the resultant trend toward an increased number of engine cylinders. Ten years ago practically all truck engines were of the four-cylinder type. Today the six-cylinder is the predominating type in the field of heavy commercial vehicles, and the eight-cylinder has been introduced and is gaining a footing in this field. The amount of chassis space occupied by the engine (and therefore unavailable for payload) increases rapidly with the number of cylinders if these are arranged in the conventional way, with all cylinders in a single bank. A V-type of engine reduces the overall length, but a V-engine generally is of nearly the same height as a corresponding vertical engine and cannot be placed under the footboards of the driver's seat without making the latter undesirably high. On the other hand, a horizontal opposed (or flat engine, as it is called in England) occupies little space in the vertical direction. It can be conveniently placed under the footboards, and it has the additional advantage of keeping the center of gravity of the vehicle low. The chief advantage offered by the horizontal form therefore would seem to be the possibility of maximum utilization of

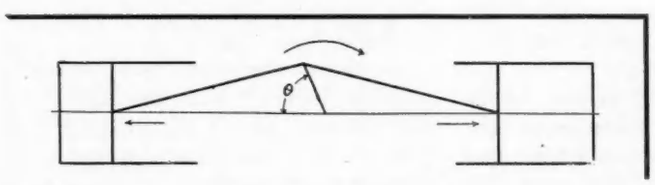


Fig. 1—Diagram of opposed cylinders

Opposed Engines for Trucks, Buses

by P. M. Heldt

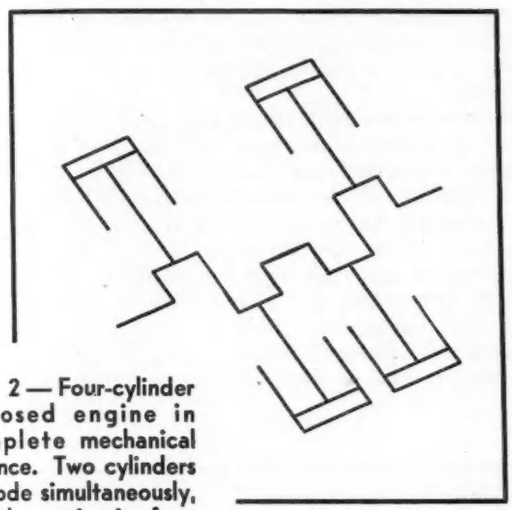


Fig. 2 — Four-cylinder opposed engine in complete mechanical balance. Two cylinders explode simultaneously, and the engine is of unsymmetrical form

chassis space for payload.

The general tendency in the design of the heavier trucks and buses for a long time has been toward greater load capacities and higher speeds, and this has meant greater power requirements. Also, it has come to be recognized more definitely in recent years that there is an advantage in comparatively small cylinders. These latter permit of increases in both the compression ratio and the speed of revolution, and therefore, of obtaining a materially greater output per unit of displacement. For these reasons it is more than likely that engines with a considerable number of cylinders, say eight or twelve, will best meet the requirements in the heavy commercial vehicle field in the future. However, we will investigate the properties of "flat" engines with from four cylinders up.

The two chief desiderata in connection with cylinder and crank layouts are an even sequence of explosions and complete balance of reciprocating parts. In a four-cylinder engine the explosions should follow one another at intervals corresponding to 180 deg. of crank motion, and this necessitates a crankshaft with all of the throws in the same plane. The reason for this is that the crankshaft is ready for an explosion when one of its throws is in the plane of the cylinder axes. This same crank throw, or another one in the same plane, will be in position to receive an impulse from the other bank of cylinders after the crankshaft has turned through 180 deg., and this is the required spacing between explosions, because there will be four explosions during two revolutions, or 720 deg. of crankshaft motion.

There is one point in connection with the balance of reciprocating parts in opposed-cylinder engines that is not generally known, and that is, that whereas the primary inertia forces on the reciprocating masses in opposite cylinders at any moment are equal in magnitude and in the same direction, so that they add together, the secondary inertia forces at any moment are equal in magnitude but oppositely directed, so that they neutralize each other, except for the fact that the axes of the opposed cylinders may not be in line but offset slightly with respect to each other. Referring to Fig. 1, the primary forces due to the reciprocating

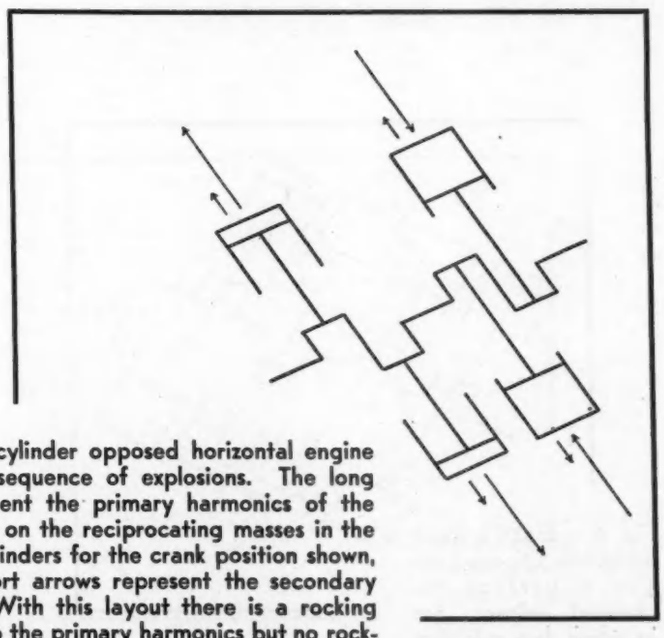


Fig. 3—Four-cylinder opposed horizontal engine giving even sequence of explosions. The long arrows represent the primary harmonics of the inertia forces on the reciprocating masses in the respective cylinders for the crank position shown, while the short arrows represent the secondary harmonics. With this layout there is a rocking couple due to the primary harmonics but no rocking couple due to the secondary harmonics

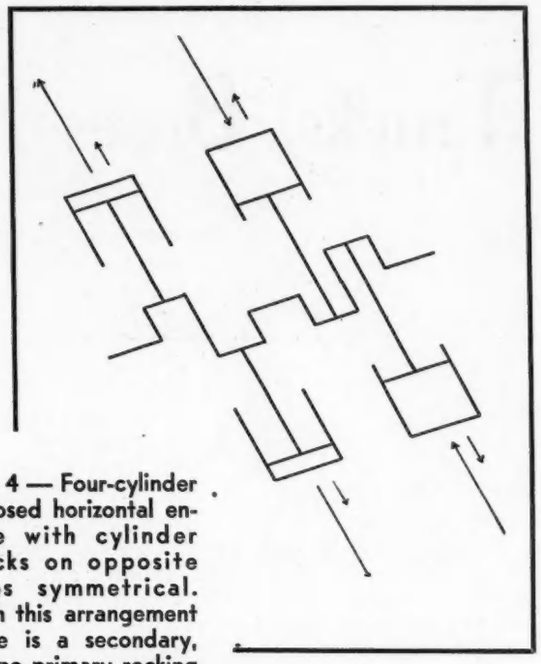


Fig. 4 — Four-cylinder opposed horizontal engine with cylinder blocks on opposite sides symmetrical. With this arrangement there is a secondary, but no primary rocking couple. Explosions occur at uniform intervals

masses in the left-hand cylinder for any crank position θ are proportional to cos θ, being directed toward the head of the left-hand cylinder when the value of cos θ is positive. The primary inertia force on the reciprocating masses in the right-hand cylinder is proportional to cos (θ + 180 deg.) = − cos θ, and is directed toward the head of the right-hand cylinder when cos θ is positive. But since the value of cos θ is the same in both cases and the expression for the primary inertia force on the reciprocating masses in the right-hand cylinder is preceded by a minus sign, both forces are in the same direction and therefore add together. The secondary inertia force on the masses in the left-hand cylinder is proportional to cos

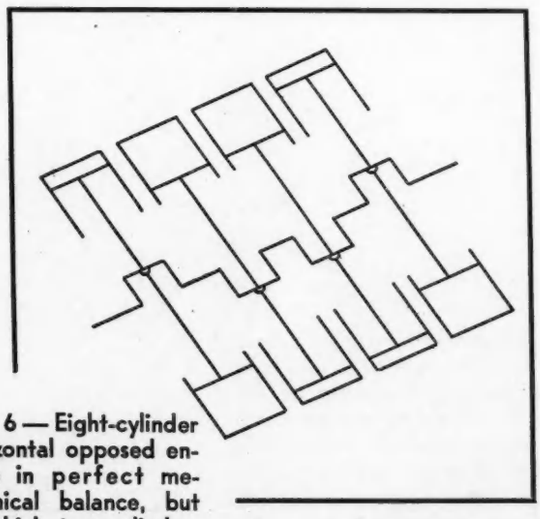


Fig. 6 — Eight-cylinder horizontal opposed engine in perfect mechanical balance, but in which two cylinders explode simultaneously

2 θ, and that on the reciprocating masses in the right-hand cylinder to cos 2 (θ + 180 deg.) = cos (2 θ + 360) deg. = cos θ. Hence, the secondary inertia forces on the reciprocating masses in the two opposed cylinders are equal in value at any time, and since each is directed toward its particular cylinder head when the value of cos θ is positive (and vice versa), the forces are opposite in direction and therefore neutralize each other.

The secondary forces of opposed moving masses are completely neutralized, however, only if the two opposing cylinders are coaxial; if they are offset sideways these forces tend to produce a rocking couple in the horizontal plane. There is, of course, the possibility of rocking couples produced by different pairs of opposing masses being in opposition, thus neutralizing each other.

Whether or not rocking couples are produced by any particular cylinder-and-crank arrangement is best determined by considering that in a vertical engine at the beginning of the down-stroke, both the primary and secondary harmonics of the inertia forces on reciprocating parts are directed upward, while at the beginning of the up-stroke the primary harmonic is directed downward and the secondary harmonic upward. By representing these harmonics on the engine diagram by means of lines on or adjacent to the cylinder axes, it can be seen at once whether harmonics

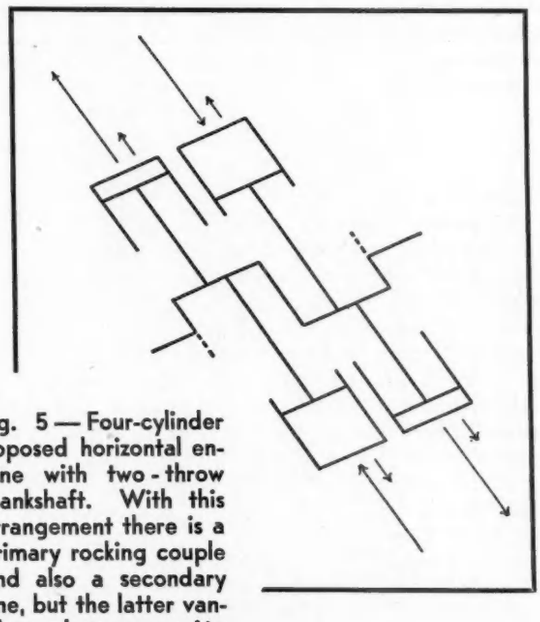


Fig. 5 — Four-cylinder opposed horizontal engine with two-throw crankshaft. With this arrangement there is a primary rocking couple and also a secondary one, but the latter vanishes when opposite cylinders are coaxial

of the same order due to the moving masses in the different cylinders cancel out or produce a rocking couple. To cancel out, the resultant of harmonics of the same order and in the same direction must pass through the center of the engine.

There are at least five possible cylinder-and-crank arrangements for a four-cylinder opposed horizontal engine. That illustrated in Fig. 2 gives complete balance of the reciprocating parts, but it is undesirable from every other point of view. Instead of giving an even sequence of explosions, two of the cylinders fire at the same time. The engine, moreover, is of rather

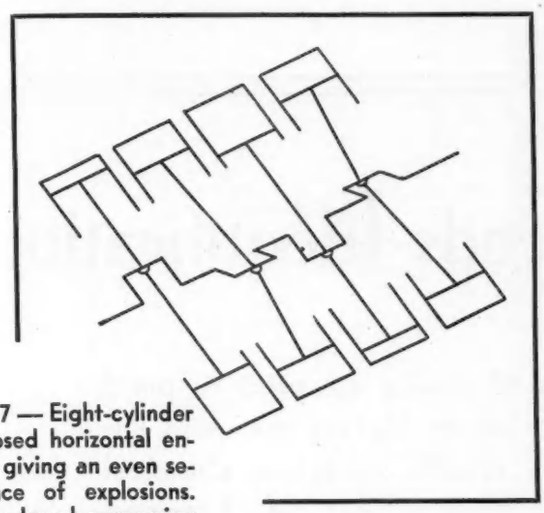


Fig. 7 — Eight-cylinder opposed horizontal engine giving an even sequence of explosions. Secondary harmonics produce no rocking couple if opposed cylinders are coaxial, but there is a horizontal rocking couple due to the primary harmonics

cumbersome form, for while the two cylinders on one side of the crankshaft are located close together, those on the opposite side are far apart and would have to be cast separately or at least from a different pattern than the other two (if these were cast together), which would be undesirable from the manufacturing standpoint. The engine would be about as long as a four-cylinder vertical engine of the same bore and stroke.

Even spacing of explosions could be assured by connecting pistons in the cylinders on one side of the crankshaft to crankpins 1 and 2, and those in the cylinders on the opposite side to crankpins 3 and 4; but aside from the fact that this arrangement results in a rather pronounced secondary rocking couple, it would probably be ruled out by the awkward shape of the engine.

Some of the disadvantages inherent in the arrangements thus far described are overcome in the layout shown in Fig. 3. The arrangement of the cylinders is exactly the same as in Fig. 2, but crank throws 1 and 3 are on the same side of the crankshaft, instead of 1 and 4. Since only two of the pistons are at the same end of the stroke simultaneously, only one cylinder fires at a time, and explosions in the different cylinders are equally spaced. Also the secondary harmonics cancel out completely, since those in cylinders 1 and 4 are in phase or in the same direction, and their resultant, therefore, is at the center of the engine, as is the resultant of the secondary harmonics in cylinders 2 and 3. The primary harmonics do not cancel out completely, because those of cylinders 1 and 3 are in the same direction and their resultant does not pass through the center of the engine, but is slightly to one side of it, while the resultant of the primary harmonics of inertia forces on reciprocating masses in cylinders 2 and 4, which is oppositely directed, is slightly to the other side of the center line of the engine.

In Fig. 4 is shown an arrangement in which both cylinder blocks are or can be identical. Explosions are evenly spaced, but the balance of reciprocating parts again is not complete. The primary harmonics of the inertia forces on the reciprocating masses in the different cylinders balance out completely, but at any given moment the secondary harmonics on the masses in the two cylinders at one end are in one direction and those on the masses in the two cylinders at the other end in the opposite direction, hence there is a horizontal rocking couple due to these harmonics.

In most lines of work it is desirable to have the engine as compact as possible, and a gain with respect to compactness can be achieved by using a two-throw instead of a four-throw crankshaft. This arrangement, illustrated in Fig. 5, has been in favor with designers of engines for light aircraft and marine work in recent years. Opposite cylinders can be made coaxial or nearly so, giving a very compact engine, and explosions come at even intervals, but a slight sacrifice is made with respect to balance. In this case the secondary harmonics balance out if opposite cylinders are coaxial, and the rocking couple produced by them is very small even if these cylinders are offset by the width of a big-end bearing. The primary harmonics produce a rocking couple in the horizontal plane, but this also can be made quite small by approaching adjacent cylinders as much as possible.

The six-cylinder engine does not seem to hold out any particular promise as a horizontal design. An even sequence of explosions can be obtained by using a six-throw crankshaft similar to that used for six-cylinder vertical engines, but, instead of having crank throws Nos. 1 and 6, 2 and 5, and 3 and 4 in line, having them opposed to each other. Pistons in cylinders on one side of the crankshaft would be connected to crankpins 1, 2 and 3, and pistons in the cylinders on the opposite side of the crankshaft to crankpins 4, 5 and 6. Such an engine would be condemned on account of its form. With six cylinders in two blocks of three, one block on each side of a three-throw crankshaft, it is impossible to get an even sequence of explosions. Explo-

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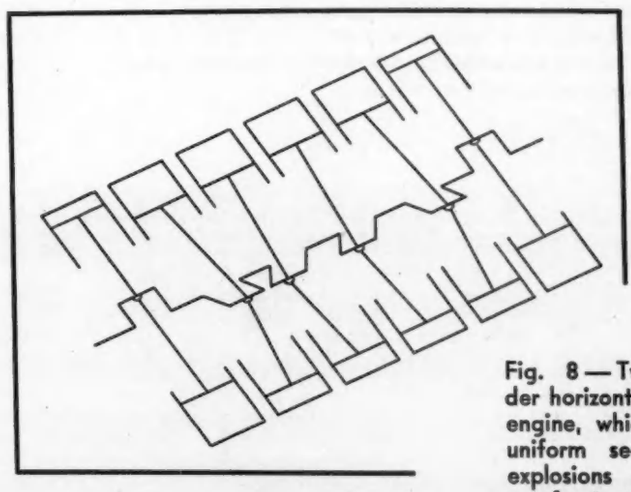


Fig. 8 — Twelve-cylinder horizontal opposed engine, which gives a uniform sequence of explosions and is in perfect mechanical balance

Spectrograph Speeds Identification of El

Latest form of device adapted to plant requirements where factory men and engineers may readily ascertain chemical substances in alloy without aid of trained metallurgists

PFFT—PFFT! A brilliant flash! And a fragment of metal yields its innermost secrets.

Troubled with a badly mixed rack of alloy steels? Need to sort scrap quickly? Or would you like to identify some obscure impurity in your new die-casting alloy?

What is it? How much? Just a speck of metal burned in an arc tells the story. Quicker than any known means of analysis—more accurate in many cases.

Once again scientific research is harnessed to a routine industrial problem. Spectrography is its latest form. Although the spectrograph is well known to many physicists and research chemists, it is a comparatively new tool so far as the large group of analysts, laboratory workers and engineers is concerned. Moreover, while qualitative results have obtained for a long time it is only recently that the equipment and technique have produced quantitative results.

But the most interesting point is that patient and persistent work has produced accessories and equipment suitable for routine laboratory work. The spectrograph has emerged from its scientific environment. Qualitative and quantitative examination of the chemical components of ferrous as well as non-ferrous metals is now within the reach of any laboratory through the introduction of a large range spectrograph capable of exploring the complex spectra of alloy steels.

To illustrate the wide range of industrial problems which come within the province of spectrography, we list the following few examples:

1. Analysis of materials purchased on specifications limiting the amount of impurities.

2. Guiding the development of alloys for die-castings, forgings, etc., by quantitative analysis for necessary constituents present in minute quantities.

3. Rapid identification of unknown substances, mixed stocks, and the sorting of scrap.

4. Checking of foundry mixtures to control special alloys.

The underlying principle upon which spectrography is based, is the fact that every chemical element, if heated to a high enough temperature so that it is partially or completely vaporized, and the vapor brought to a condition of incandescence, emits light which is composed of a number of discrete wave lengths definitely characteristic of that element. Every student of chemistry is acquainted with this phenomenon, which is shown by the familiar flame tests for sodium, potassium, lithium, etc.

From some elements, the emitted light contains but a few individual wave lengths, as in the case of the alkalis mentioned. From others, including iron, tungsten, and cobalt, it contains an enormous number, running into the thousands. In every case, however, these wave lengths are perfectly definite and unchangeable, no matter what the source or state of combination of the element.

The most obvious characteristic of the method is extreme sensitiveness, permitting the detection and estimation of amounts of many elements so small as to be inappreciable when sought for by the more con-

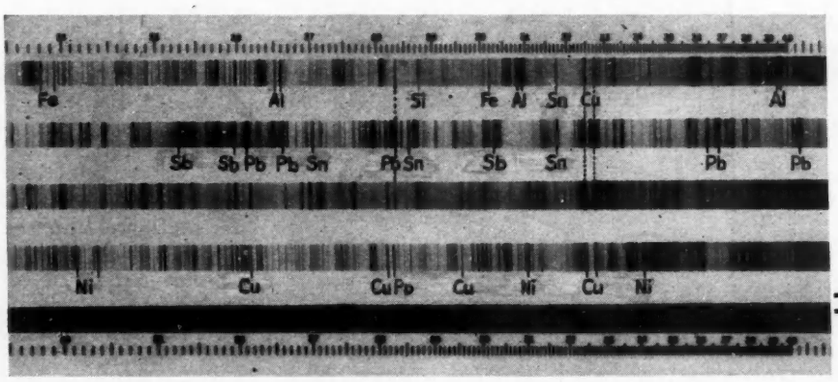


Fig. 1—Spectra of various metals with a few lines marked for identification. Made with a medium quartz spectrograph

Elements in Metals

by Joseph Geschelin

Large Littrow quartz spectrograph in the laboratory

ventional methods. Numerous cases have been found where these apparently negligible traces, properly identified and determined, have provided the solution of baffling problems, involving the physical properties of metals and alloys.

Sometimes the amount of material available is too small to permit chemical analysis, but ample for the spectrograph. Even a fraction of a milligram of sample will often suffice to reveal in the spectrum all the essential components of a material. Ten to 50 milligrams are enough to permit the detection of practically all metallic and some non-metallic constituents, even those present to the extent of a few thousandths of one per cent or less.

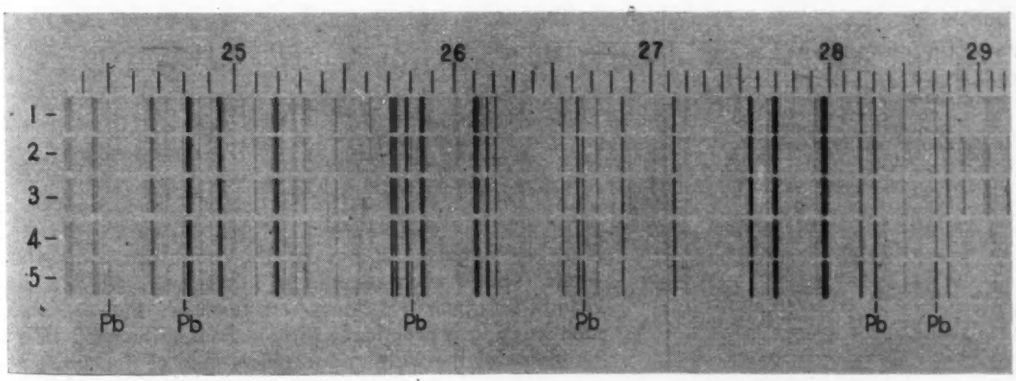
The best of the quantitative spectral methods permit an accuracy of about one part in 20 of the element determined, irrespective of the absolute amount. This, of course, means that if the constituents are present in large amounts, the errors involved may be correspondingly large. In such cases chemical methods are generally to be preferred to spectrographic.

There are some determinations for which the spectrograph is not suited. The non-metals, in general, do not lend themselves as readily as the metallic elements to spectrographic analysis. Thus, in iron and steel, the sulfur, phosphorus and carbon cannot readily be determined in this way. The metallic constituents, however, copper, nickel, manganese, chromium, aluminum, molybdenum, vanadium, tin, tungsten and many others are positively and quickly identified and may be determined quantitatively. Some of these analyses can be completed so quickly and accurately by standard chemical or colorimetric methods that the spectrograph offers no advantage, but for many of them it will both save time and insure greater accuracy.

The spectrograph is essentially a photographic camera, so arranged and focused as to take, simultaneously, on a sensitive plate, a group of images or pictures of a narrow slit through which the light to be examined is admitted to the instrument. This light passes through a system of lenses and a prism whereby the individual wave lengths are sorted out and a separate image produced by each of the component wave lengths.

(Turn to page 382, please)

Fig. 2—Quantitative determination of lead in a zinc alloy. Taken with medium quartz spectrograph. Each spectrum taken with 0.1 cc of a 20% solution of the indicated sample on graphite arc electrodes



1 — Standard containing 0.06% lead.
2—Sample.
3 — Standard containing 0.25% lead.
4—Sample (Same as No. 2).
5 — Standard containing 1.0% lead.

Referring particularly to lead lines at 266mμ and 287mμ note that those in the spectra of the sample (Nos. 2 and 4) are distinctly stronger (darker) than the corresponding lines in the spectrum of Standard No. 3 (0.25%) and much weaker than those of Standard No. 5 (1.0%). Visual comparison on original plate indicates 0.4% lead in the sample.

Direct Operating Ch of Motor Trucking Ex

DIRECT operating expenses constitute 57.47 per cent of the cost of motor truck freight transportation, while overhead expenses account for the remaining 42.53 per cent, a study just completed by the U. S. Department of Commerce revealed.

The information contained in this report was secured through personal interviews from 217 motor-trucking concerns in 41 states and the District of Columbia. Data as to truck and trailer equipment and hauling radius were generally available, especially from operators making regular trips over fixed routes. Comprehensive figures on operating costs, however, were scarce, and only 122 firms supplied cost data in sufficient detail to permit statistical analysis. Motor trucking as an industry is still new and unorganized. Equipment and methods have been changing rapidly. There is little accumulated experience for guidance, and each operator must work out, almost alone, the solution for his own particular problems.

Although there is apparent some tendency toward consolidation and large-scale operation in the motor-freight field, the industry is still predominatingly one of small fleets and individual management. Scientific accounting is the exception rather than the rule, direct personal familiarity with the business taking the place, however inadequately, of elaborate records.

Of the 217 operators included in the survey, 103 reported a common-carrier business only, 41 contract hauling only, while 73 reported both common-carrier and contract hauling. The disproportionate representation of the larger operators is brought out in Tables 1 and 2, showing gross revenues for 1930, and size of fleets, respectively.

The variety of equipment apparent in a comparison of different operations and different sections of the country is indicative of a marked specialization of motor-truck chassis and body design for particular types of hauling service.

By far the greater number of trucks and trailers may be described as being in the "general purpose" class, that is, they are all reasonably well adapted to miscellaneous hauling of whatever freight is offered. Their suitability to any given job depends primarily on how well their capacity, speed and economy of maintenance are adapted to the particular demands made upon them.

Even for general hauling there is a wide range of sizes from which to choose and a considerable variety in body and chassis design. They range from the light express truck, of ½-ton capacity, to a tractor truck, semi-trailer, and trailer combination, capable of carrying 90,000 lb. gross load, on 30 balloon tires.

Table 3 shows, by geographic divisions, the rated capacities of vehicles reported. Table 4 shows the per cent of power units (trucks and tractor trucks) in each capacity group.

Few marked differences appear in the average or predominating rated capacity of trucks in the several sections of the country as above grouped. The factors determining the choice of truck are so many that they tend to cancel out in a large sample. There is some evidence, however, that the larger vehicles are more usual in those sections where the principal cities and towns have been linked with paved highways. This is brought out by regrouping the states according to the progress they have made in paving their state highway systems, as shown in Table 5.

One of the more important aims of the survey was to secure data relative to weights of trucks and loads carried. So far as it was obtainable, information was recorded covering the tare weights of the trucks

Table 1—Gross Revenues, 1930, of Trucking Concerns

Gross Revenue	Number of Concerns	Per Cent of Concerns
Under $5,000	5	2
$5,000 to $9,999	14	6
$10,000 to $19,999	16	7
$20,000 to $49,999	40	19
$50,000 to $99,999	34	16
$100,000 and over	60	28
No revenue data given	48	22
Total	217	100

Table 2—Size of Fleets of Trucking Concerns

Size of Fleet	Power Units: Number of Concerns	Power Units: Per Cent of Concerns	All Units: Number of Concerns	All Units: Per Cent of Concerns
Vehicles				
1 or 2	16	7.4	15	6.9
3 or 4	31	14.3	22	10.1
5 to 9	69	31.8	58	26.7
10 to 14	30	13.8	35	16.1
15 to 19	21	9.6	27	12.4
20 to 49	39	18.0	36	16.6
50 to 74	7	3.2	14	6.5
75 to 99	3	1.4	4	1.9
100 and over	1	0.5	6	2.8
Total	217	100.0	217	100.0

Fig. 1—"Regular" routes of the truck operators from whom reports were secured in this survey. It does not include irregular or "anywhere-for-hire" hauling, since such trucking is practically without limit. The map clearly indicates the wide geographical field of the survey

Charges Cost 57% Expense, U. S. Finds

used, the "usual loads" carried, and the gross weights of the loaded trucks. The "usual load" was taken to mean not an average load, but that load which the operator regarded as a normal or capacity load for a given vehicle, assuming sufficient freight was available. The usual load was not the maximum load, since many operators stated that they hauled loads considerably in excess of normal capacity under emergency conditions. Nor was usual load equivalent to rated capacity, as it is commonly agreed that practical working capacity is in excess of listed rating. Gross weight was computed as the sum of tare weight and usual load as defined above.

It was found that the largest trucks, those of 5½ tons and over, show an average load 7.6 per cent below their rated capacities.

Usual loads were reported, in very rare instances, as high as three times the manufacturers' ratings. Normally, however, the excess was less than 125 per cent. Approximately one-fourth of all trucks and more than one-third of the medium-capacity trucks were reported as carrying 100 to 125 per cent above capacity—roughly, double their rated capacity. Nearly two-thirds of the heavy trucks carried less than 50 per cent above capacity.

The liberalizing of gross-weight restrictions in favor of six-wheeled vehicles (that is, those having three axles) has been a recent development in a number of states. It is the wheel load rather than the gross load which determines stress in the pavement. Larger loads are possible, therefore, with the six-wheeled trucks and are legalized in an increasing group of the states.

Furthermore, for light trucks well within existing gross-weight limitations a third axle may greatly increase the safe and economical carrying capacity. That this is generally recognized by truck operators is indicated by the fact that 8.7 per cent of the trucks were on six wheels. The number of six-wheeled tractor trucks was negligible, inasmuch as a tractor truck and semi-trailer combination is, in effect, a six-wheeled unit.

Only two six-wheeled tractor trucks were reported, these being used for heavy hauling, with large-capacity semi-trailers. One heavy semi-trailer on two axles was reported. Of the trailers listed (excluding semi-trailers) 14.3 per cent were on six wheels.

Because of the absence of powerplant, and resultant low chassis weight, the capacity loads of trailers run much higher than for trucks operating under the same legal gross weight restrictions.

Pneumatic tires are rapidly displacing solid tires on motor trucks. Only 3.6 per cent of the total output of motor trucks in 1930 were equipped with solid tires. However, there are still many older trucks on the roads that have not been converted to pneumatic equipment. Analysis revealed that 24 per cent of the trucks and tractor trucks and 32 per cent of the trailers reported were on solid (or "cushion") tires on one or more axles.

This proportion of solid-tired vehicles was unexpectedly high, but an examination of the original data reveals that of the 652 solid-tired trucks and

Table 4—Per Cent of Trucks and Tractor Trucks, by Capacity Groups

Geographic Division[1]	Light, ½ to 1¼ Tons	Medium, 1½ to 3 Tons	Heavy, 3½ Tons and Over	Total
New England	11.4	49.3	39.3	100
Middle Atlantic	2.6	34.8	62.6	100
East North Central	7.5	67.0	25.5	100
West North Central	10.2	73.4	16.4	100
South Atlantic	5.1	80.9	14.0	100
East South Central	16.0	56.3	27.7	100
West South Central	9.5	67.9	22.6	100
Mountain	13.6	64.8	21.6	100
Pacific	16.5	49.6	33.9	100
United States	10.0	57.3	32.7	100

[1] According to U. S. Bureau of the Census.

Table 5—Rated Capacity of Trucks, According to Progress of State Highway Systems

Road Mileage Improved With High-Type Surfaces	States	Number of Trucks	Average Rated Capacity, Tons
50 to 100 per cent	7	739	3.23
25 to 49 per cent	13	1,110	3.10
20 to 24 per cent	5	415	2.55
Up to 19 per cent	23	531	2.21
Total	48	2,795	2.88

Table 3—Rated Capacity of Vehicles Reported, by Geographic Divisions

Geographic Division[1]	Light Vehicles ½ to 1¼ Tons				Medium Capacity Vehicles, 1½ to 3 Tons				Heavy Vehicles, 3½ Tons and Over				No Capacity Data			
	Trucks	Tractor Trucks	Semi-Trailers	Trailers	Trucks	Tractor Trucks	Semi-Trailers	Trailers	Trucks	Tractor Trucks	Semi-Trailers	Trailers	Trucks	Tractor Trucks	Semi-Trailers	Trailers
New England	31	.	.	.	134	...	..	...	103	4	11	1	23	8	1	..
Middle Atlantic	14	.	.	.	190	...	..	8	255	86	100	54	3	32	12	..
East North Central	38	1	2	3	265	85	27	18	75	58	151	96	..	4	..	3
West North Central	39	.	.	.	260	22	9	44	32	31	80	13	1	11	5	..
South Atlantic	13	.	.	.	199	9	10	11	35	1	5	1	1	4	..	..
East South Central	19	.	1	.	58	9	3	1	26	7	11	7	..	..	1	..
West South Central	16	.	.	.	86	28	22	18	7	31	38	20	41	15	16	5
Mountain	24	.	.	1	109	5	4	11	38	...	1	3	1	1	3	..
Pacific	128	.	.	5	384	2	8	69	248	16	21	137	13	2	6	74
United States	322	1	3	9	1,685	160	83	180	819	234	418	332	83	77	44	82

[1] According to U. S. Bureau of the Census.

tractor trucks, 167 were operated by a single firm, principally in a metropolitan area. If this firm is excluded from the tabulation the percentage of solid tires drops to 19. It is likely, too, that some of the solid-tired equipment was so obsolescent as to be used relatively infrequently as compared with the more modern vehicles.

Of the trucks and tractor trucks dating from 1925 or older 53.2 per cent were on solid tires, whereas the 1926 and later models were only 9 per cent on solids, and of the 1929 and later models only 2.5 per cent were on solids. This would indicate that the intercity commercial truckers are now buying proportionately fewer solid-tired vehicles than other trucks users, which seems reasonable in view of the need for greater speed in the long-haul work.

Many of the larger trucking companies, especially those doing a common-carrier business, are splendid examples of efficiently conducted enterprises, utilizing the most modern of business methods. The activities of these large concerns are sometimes divided into separate departments, such as traffic, auditing and maintenance, each under experienced supervision. In such organizations adequate accounting records are highly essential to the administrative officials.

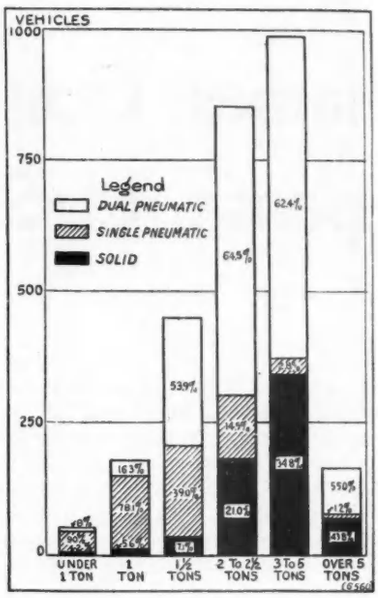
Tire cost during a brief period of operation depends to a large degree upon the expenditures for new tire equipment. Other conditions affecting tire cost are road surfaces and grades, loads carried, maintenance (tire repair, inflation, wheel alignment, brake adjustment, etc.), driver ability, traffic conditions, and frequency of stops. Many of these factors affect other operating expenses.

The majority of the vehicles for which tire costs are given are equipped with pneumatic tires, with dual pneumatics on the rear wheels. The extremely small number of typical vehicles otherwise equipped does not allow a comparison of tire costs as between various types of tire equipment. Only a few of the vehicles listed are equipped with solid tires, but it may be significant that the other operating expenses per mile for these trucks tend to be high.

Gasoline costs tabulated include the gasoline tax. Few operators made any attempt to keep the tax as a separate item of expense, since it was not considered essential to their accounting records. Nevertheless, the gasoline tax is often one of the largest single items of tax cost. The average gasoline tax in 50 representative cities in the United States in June, 1930, was 23 per cent of the average service-station gasoline price, not including tax, according to figures compiled by the American Petroleum Institute.[1]

In many localities the tax will be a much larger proportion of the gasoline cost, especially if the operator purchases at wholesale prices. In comparing fuel costs the differences in gasoline price (including tax) in different parts of the country must be taken into consideration. The number of gallons consumed was rarely reported, however; hence the price per gallon cannot be computed from the total cost of the gasoline as set forth in the table.

While the cost of oil and grease is relatively small as compared with other items of expense, it is by no means insignificant. Vehicles vary in their lubrication needs according to age and design and according to the conditions under which they are operated. The policy followed by a truck operator with respect to lubrication will not only affect this one item of cost, but may have a much more important effect upon maintenance and repair expense.



Tire equipment of trucks and tractor trucks by capacity

The only marked uniformity that appears anywhere is in the depreciation for both medium-capacity and heavy-duty trucks, where the frequency of the 3-cent rate is easily explained by the fact that these trucks were depreciated on an arbitrary 3-cents-per-mile basis, 12 of them in the medium-capacity class and 7 in the heavy-duty class belonging to a single operator.

An approximation of gross expenses per mile for the several truck-capacity groups may be reached by adding to each figure for total direct operating costs a proportionate addition to cover the overhead costs. This, of course, is equivalent to allocating the overhead costs in proportion to direct operating costs. The analysis of fleet costs in the following section of this report shows that direct operating cost averaged 57 per cent and overhead cost 43 per cent of the total. On this basis Table 10 gives an approximate gross expense per truck-mile for medium, heavy and extra heavy trucks.

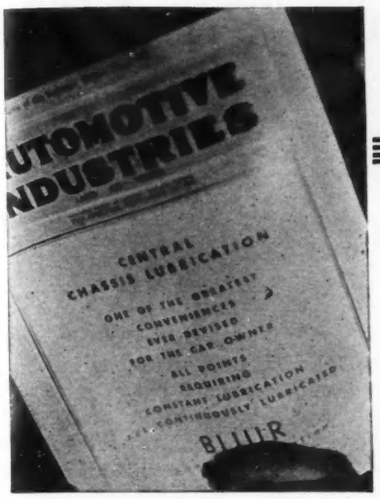
The percentage figure for total operating costs shows an almost consistent decrease in successive groups of higher gross expenses, this being offset by the increase in the ratio of fixed or overhead expenses to gross expenses for these groups.

Greater ownership of facilities by firms engaged in large-scale operations is evidenced by the decreasing ratio of rental expense to gross expenses in successive groups. The maximum ratio figure for this expense, 7 per cent, occurs in the lowest classification of $10,000 to $25,000, and the minimum of 2.7 per cent in the highest classification of $250,000 and over, with a consistent decrease for the intervening groups.

Miscellaneous expenses compromise a multitude of unclassified costs. Many of them constitute quite a large proportion of the total gross expenses for some concerns, but vary greatly both in amount and character, with no one type occurring in a sufficient number of operations to merit a separate classification.

[1] Petroleum Facts and Figures, third edition (1930), American Petroleum Institute, p. 49.

October 15 . . . .



Production & Factory Equipment Issue . . . . . .

PRODUCTION LINES

Machine Tool & Equipment Show

October 15 is the date for the annual Production and Factory Equipment Issue of *Automotive Industries.*

For more than a year automotive manufacturing executives have been working hard to solve this riddle:

"How can lower-priced quality products be produced at a profit?"

With so much attention focused upon this problem, the editorial staff of *Automotive Industries* is planing another "Machine Tool and Factory Equipment Show."

The "exhibits" are being carefully selected.

The "space" allotted to each will be brief, but will include all of the essential features.

The whole will be compressed, bound and delivered to the machine tool and equipment buyers in the automotive industry as a part of the 1932 PRODUCTION AND FACTORY EQUIPMENT ISSUE of *Automotive Industries.*

Watch for it.

Solves Conveyor Problem

The Lamson & Sessons Co. had experienced difficulty in the transfer of tote pans loaded with bolts, and weighing 70 to 150 lb., to a gravity conveyor.

These pans are lifted by two endless chains with conveyor carriers, then lowered and placed on the gravity conveyor. Each pan, when placed on the gravity conveyor, should slide and make room for the next pan.

But often this didn't happen. This meant that the second pan was deposited on top of the first one, and so on.

The problem was solved by installing a light source on one side of the gravity conveyor and a General Electric photoelectric relay on the other.

Now, if a pan fails to slide along on the gravity conveyor, it interrupts the beam of light.

The phototube promptly actuates the relay, stopping the endless chain, and allowing no more tote pans to come down until the blocking pan is shoved along.

Double Check

"Decibel and Dingbat" in this department, on Aug. 13, brought up one of the troublesome problems in automotive production. To wit, the need for a positive means of measuring noise in engines, gear sets, etc. Writes a prominent mid-west ball-bearing maker that they are using a novel audio apparatus for the purpose. "Go and No Go" read on a dial instead of by tin ear. We'll be glad to tell you more about it.

Follow Thru

This year our versatile Detroit editor has turned in several articles showing how machine tool builders can help the designer as well as production department in anticipating new production needs. The big PRODUCTION ISSUE, which comes out Oct. 15, supplies the medium for exchange of ideas. Most of the issue will be devoted to the new improved equipment developed for every activity in the plant. Here is the opportunity to get the last word. It may show you the very equipment you need for that new design. Watch for it. Oct. 15 is the date.

Safety First

"Foremen's Safety Conferences," a new publication issued by the Policyholders Service Bureau of the Metropolitan Life Insurance Co. presents a method being used rather widely to develop safety interests among foremen. It offers suggested programs for a series of seven informal conferences to discuss the various phases of safety work, these meetings being presided over by some representative of the management. The programs, which are confined to the fundamental principles of safety work, were developed from a review of the activities of a number of industrial organizations.

Mounted Right

A right handsome little booklet about Norton mounted wheels and mounted points has just come in. Although these tools were mentioned in *Automotive Industries* recently, the booklet tells more about them including some specifications and price tables. Norton certainly knows how to dress up the technical stuff in the modern manner.

Now Dickite

Press dispatches say that Dickite, a rare mineral known to exist in only 10 other places in the world, has been discovered in a coal mine near Pottsville, Pa.

This substance is used in porcelain manufacture; also as a pigment; for mixing with graphite, and as a filler for paper and textiles. It is a white crystalline material classified in the kaolin group of the mineral family.—J. G.

MANUFACTURING MANAGEMENT METALLURGY

Spicer Develops Production M

by Athel F. Denh

PRODUCED by Spicer Mfg. Corp., and known as the model 30, the axle developed for the Rockne "65" has an interesting history and an interesting sequence of assembly operations developed as the direct result of design requirements. The history goes back to the time when R. A. Vail and Roy E. Cole, after leaving the Durant Motor Co., started out independently to design a light, efficient, low-priced car. This car was to weigh as close to 2000 lb. as possible, and yet be able to withstand all modern driving requirements. This car later became the Rockne.

Importance in such a design naturally attached to the axle. A more rigid design would permit lighter weight obviously. Out of this work, cooperated in by Spicer, grew the axle in question. It will be remembered that in this design the usual banjo arms are eliminated, and the carrier and differential are held rigidly in the carrier housing.

In the design of this housing major attention has been given to prevent flexing in service operation. It was believed, and results to date seem to have indicated that if such flexure could be reduced or eliminated, the need for service adjustments would be reduced in the same proportion and noise would also be reduced.

Working on this basis a highly accurate method for assembly of the axle was evolved by Spicer, to insure that axles leaving the factory would require no adjustment. Primarily it was decided to use shims for this purpose rather than a screw adjustment, as shims obviously enabled a closer predetermination—before assembly—of clearance conditions, etc., as they would exist in the axle when completely assembled.

All final assembly operations are conducted with the use of gages. Fig. 1 shows a gage for measuring the carrier for cone center distance. The arms of this gage rest on the finished bearing bores. The gage accurately measures the distance from the shoulder of the rear drive pinion bearing to the differential bearing seats. This, together with a gaging of the bearings themselves for depth, determines the number of

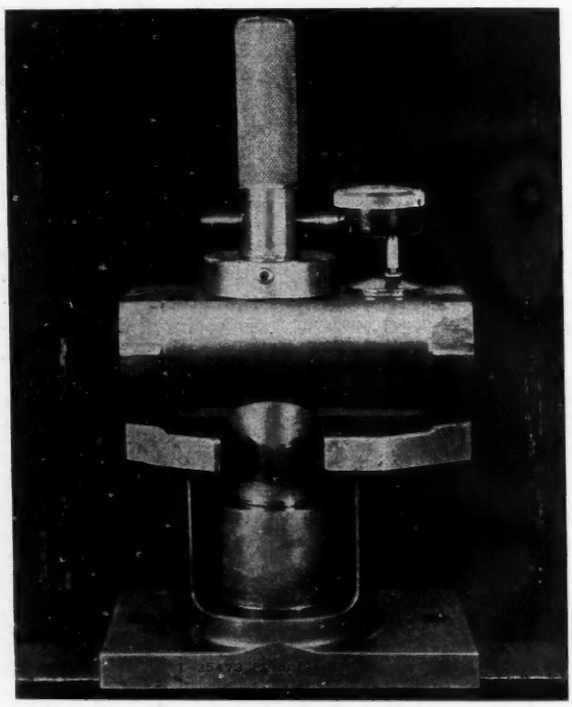


Fig 1—Gage for measuring cone center distance, etc.

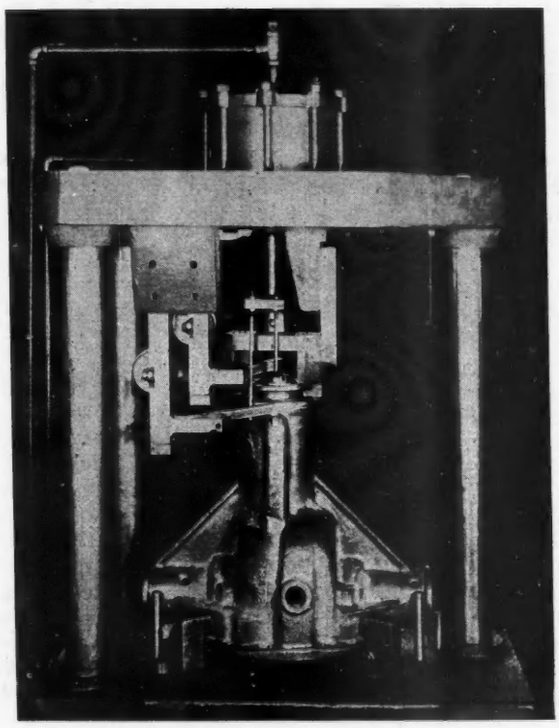


Fig. 2—Final check for pinion shaft end-play

Method for Strong, Light Axle

Denham

shims required back of the pinion bearings. Variations in bearing sizes are thereby eliminated as a factor.

Next the necessary shims are added and one cone and the assembly thus far gaged for the number of shims required between the bearings. The pinion shaft, nut, and dust cover are then assembled in place and the assembly checked for end-play, as shown in Fig. 2. End-play is held to not less than 0.001 in. or more than 0.002 in. under a reversing load of approximately 1400 lb., applied with the hydraulic press shown.

The differential carrier is next assembled in place with dummy bearings, in order to check for the shims required for correct end-play. Here again the actual bearings to be used are checked for length and the deviation from the standard added to or subtracted from the number of shims indicated by the gage as necessary. This operation is illustrated in Fig. 4. It will be noted that this measurement takes into consideration the important factor of proper back-lash for quiet operation, etc.

Bearings and shims are then assembled on to the differential carrier, while Fig. 3 shows the special fixture developed to assembled ring gear and differential assembly into the housing (where the pinion, of course, has already been assembled).

The rams of this fixture hold the differential assembly and bearings firmly in place. The assembly is seated into the housing under pressure. Following completion of assembly, the axle is subjected to a noise test in a "silent" room.

Axle tubes are pressed into the housing on Lucas presses thereafter and arc-welded at countersunk holes at each end. It will be noted that there is considerable flexibility in this design as far as tread width is concerned, the only change necessary being in the length of the tubes and axle shafts. A feature of the axle which has been pointed out previously in these columns is the provision for pinion-bearing lubrication through two holes through which the oil flows to them and returns, the ring gear virtually serving as an oil pump.

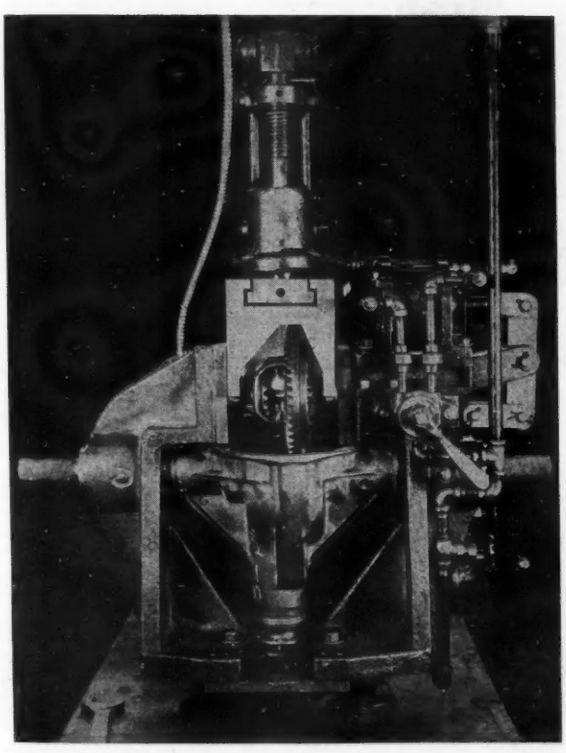


Fig. 3—Assembling the complete differential carrier and ring gear into the Spicer 30 axle housing, under pressure

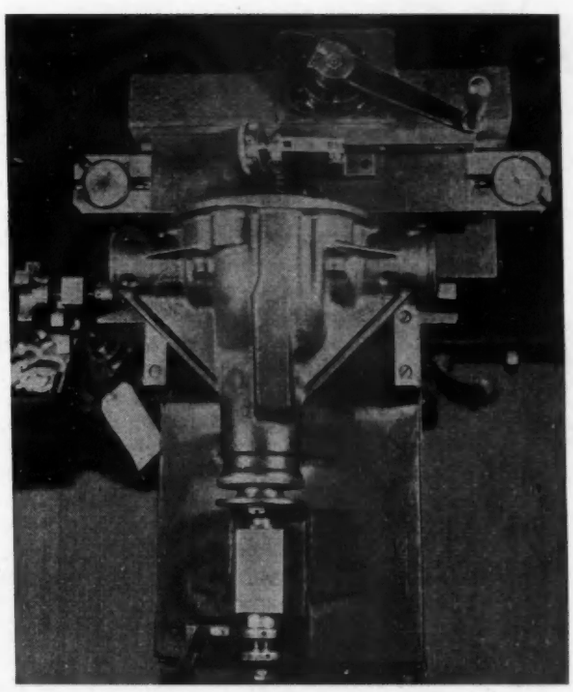
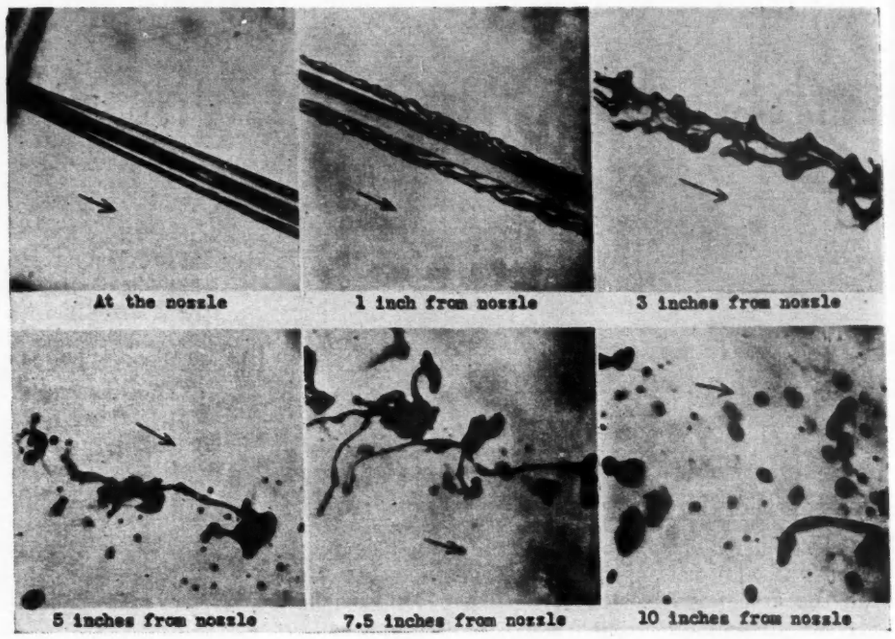


Fig. 4—Checking side-play, back-lash, and determining differential side-bearings shims required in the Spicer 30 axle

Fuel Spray Study Made With Camera

Langley Laboratory builds novel photomicrograph device to study sprays from open and automatic nozzles



Photomicrographs showing various stages in the breakdown of a low-velocity fuel jet. Photographic magnification 10 to 1; reduced in reproduction in the ratio of 3 to 2

Injection pressure, 100 lb. p. sq. in.; air density, 1 atm.; orifice diameter, 0.020 in.

A PHOTOMICROGRAPHIC study of fuel sprays has been begun at Langley Memorial Aeronautical Laboratory, and some preliminary results are given in Technical Note No. 424 of the National Advisory Committee for Aeronautics, by Dana W. Lee and Robert C. Spencer.

Photomicrographs at a magnification of 10 were made with a microscope with camera attachment. Camera lenses mounted in the end of a box about 2 ft. long gave satisfactory photographs at magnifications of 2.5 and 3.25. Illumination was furnished by a spark discharge, with the spark gap located directly behind the sprays, so that the photographs obtained were silhouettes.

Both open and automatic-injection nozzles were used, and synchronization of the spark and the spray was accomplished by a rotary disk switch on the same shaft with the cams producing the injection. The spark could be made to occur at any desired stage in the development of the spray by changing the phasing of the disk switch with respect to the camshaft. The sprays from the automatic injection valve were injected into a glass-walled chamber, in which the air density could be maintained above or below atmospheric. The sprays from the open nozzles were continuous, and were always injected into air at atmospheric density, the fuel being supplied under pressure from a reservoir arranged to maintain a constant pressure for several seconds. In this case the timing of the spark was manually controlled. The open nozzles were used with injection pressures up to 1000 lb. p. sq. in., because the operation of the automatic injection valve was erratic at this and lower pressures.

Only the core of the spray was sufficiently dense to show in the silhouettes and most of the minute drops in the envelope of the spray do not appear.

It was found that the fundamental processes involved in spray formation could be better observed in photomicrographs of sprays in air at atmospheric density than in those made at higher air densities. Fine details of sprays in dense air were so obscured by the cloud of mist surrounding the core that clear photographs could not be obtained.

The illustration shows six stages in the development of a fuel spray injected at a low pressure into the atmosphere. It will be noticed that the fuel column begins to ruffle near the nozzle, and the ruffles grow in magnitude as the distance from the nozzle is increased. At still greater distances ligaments are formed, which then collapse to form drops.

The studies thus far made of the photomicrographs of fuel sprays indicate:

That the theory of air-stream atomization, advanced by Dr. R. A. Castleman, Jr., appears to be directly applicable to the atomization of fuel sprays of the solid-injection type.

That at a given distance from the orifice, the disruption of the jet and the dispersion of the fuel increase with an increase in the jet velocity or an increase in the air density.

That at a given value of jet velocity and air density, the disruption of the jet and the dispersion of the fuel increase with distance from the nozzle until the relative velocity between the fuel and the air becomes so low that the air no longer tears the fuel apart.

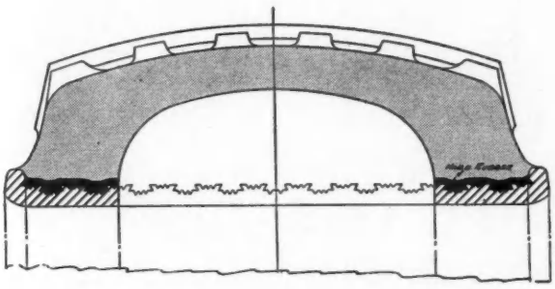
That at atmospheric and subatmospheric air densities, there may be wide differences in the dispersion of sprays from different nozzles of the same geometric design because of slight irregularities in the nozzles, and also between the early and later parts of sprays from nozzles used with automatic injection valves. At air densities corresponding to those in compression-ignition engines at the time of fuel injection the differences are slight.

"Zero-Pressure" Tires for Tractors

Goodrich "Zero-Pressure" cushion tire

A NEW form of cushion tire, known as the "Zero-Pressure" tire and specially designed for use on agricultural and industrial tractors, has been placed on the market by the B. F. Goodrich Rubber Co., Akron, Ohio. As may be seen from the illustrations herewith, the tire section is substantially of arch form. Under light load the central portion of the arch, forming the tread, yields readily, hence the tire has considerable cushioning power; but as the load on the tire increases the pillars of the arch act as abutments and reduce the rate of deflection.

Farm tractors are normally equipped with steel wheels without special tires, but the use of rubber tires reduces slippage and, of course, a rubber-tired tractor is more comfortable to ride upon. In certain lines of tractor work, as in orchards, sugar plantations, vineyards and the like, the rubber tire is said to offer advantages in not injuring the roots near the surface of the soil. When tractors are being used on paved roads it is practically necessary to use rubber tires in order to prevent injury to the pavement.



Section of Goodrich "Zero-Pressure" tire

The tire consists of an all-rubber arch built on a slotted steel base for solid-tired wheels. Under load, because there is no air pressure on the inside, the tire assumes a concave tread profile. It is claimed that in soft soil or sand this results in packing the material under the center of the tire, producing a track for the tire to ride on.

It is said that the use of these tires on tractor wheels makes it possible to greatly lower the weight of these wheels.

McCormick-Deering Tractor Tested

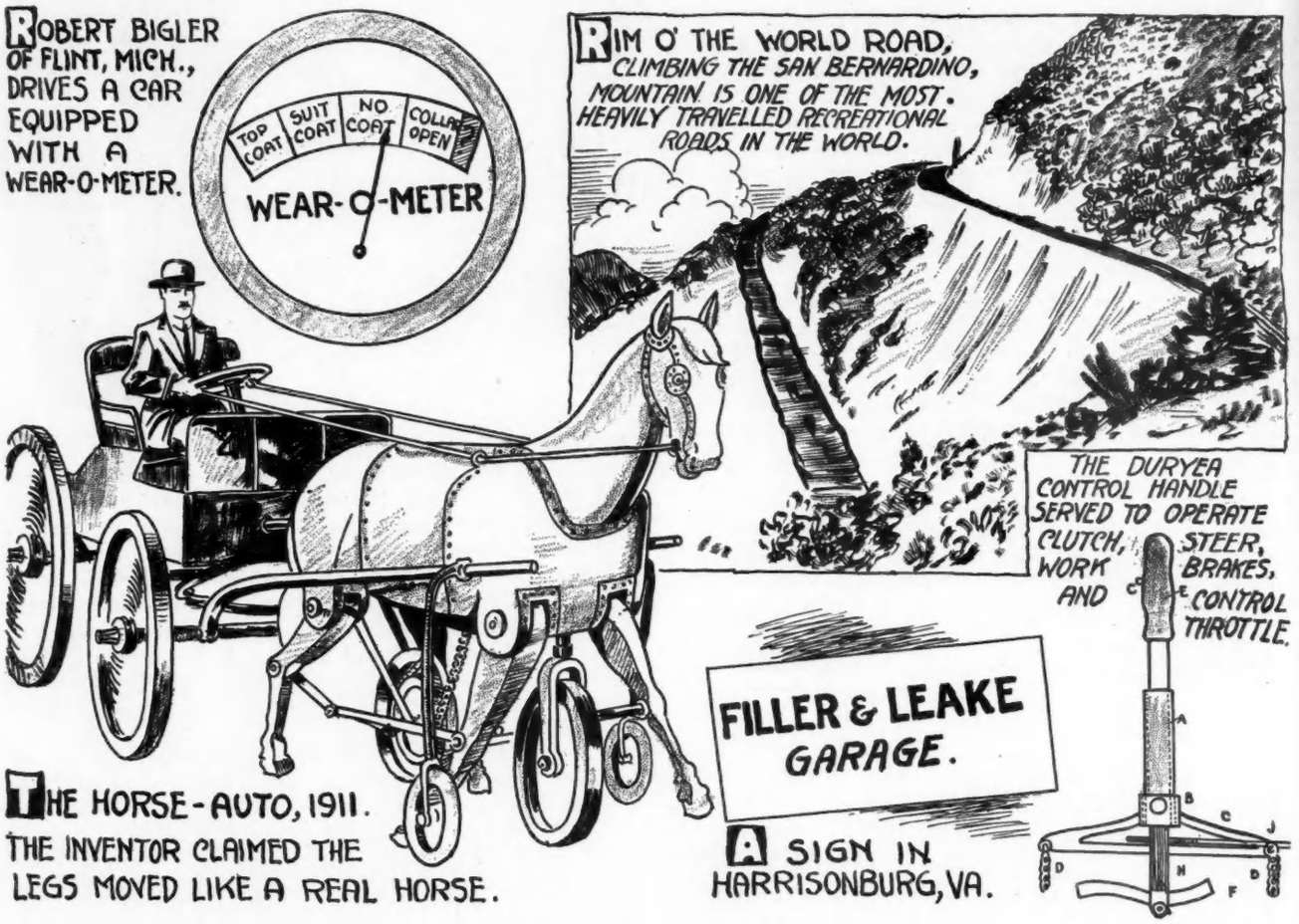
OFFICIAL tractor test No. 210 of the University of Nebraska was made on a McCormick-Deering W-30 tractor manufactured by the International Harvester Company of Chicago. This is a wheel-type tractor equipped with a four-cylinder vertical engine of 4¼-in. bore and 5-in. stroke. The engine has an inlet-valve port diameter of 1.697 in. and an exhaust-port diameter of 1.479 in., and its rated operating speed is 1160 r.p.m. It is fitted with a Zenith carburetor, and with a magneto, governor and air-cleaner manufactured by the International Harvester Company, the governor being of the flyball, and the air cleaner of the oil-washed wire-filter type. Lubrication is by the circulating splash system.

The clutch is of the single-plate dry type (International Harvester Co.) and is operated by foot. The transmission affords three forward speeds, advertised as 2½, 3¼, and 3¾ m.p.h., and one reverse speed, 2¾ m.p.h. Driving wheels are 42 in. in diameter and 12 in. wide, and are provided with spade-type driving lugs, 32 to the wheel, 5 in. high and of 3⅜ in. face. The equipment includes extension rims 6 in. wide and with 16 lugs of the same size as used on the wheels.

In the maximum-load test of the engine, for one hour, 33.26 hp. was developed at 1160 r.p.m., with a specific fuel consumption of 0.663 lb. p. hp.-hr. No water was injected into the cylinders. In the rated-load test (1 hour) the engine developed 31.62 hp. at 1160 r.p.m. with a specific fuel consumption of 0.643 lb. p. hp.-hr. In the varying load test, of two hours duration, the engine developed a minimum of 0.46 hp. with a fuel consumption of 0.35 gal. per hour, and a maximum of 32.70 hp. with a specific fuel consumption of 0.655 lb. p. hp.-hr.

In the rated-load test of the tractor, for 10 hr. in intermediate gear, a drawbar pull of 2008 lb. was developed at 3.78 m.p.h., corresponding to 20.23 drawbar horsepower. The slip of the drive wheels was 3.94 per cent and the specific fuel consumption, 0.956 lb. per drawbar hp.-hr. In the maximum drawbar-load test the drawbar pulls and the speeds on the different gears were as follows: Low-speed, 3118 lb., 2.92 m.p.h.; intermediate-speed, 2359 lb., 3.71 m.p.h.; high-speed, 1961 lb., 4.34 m.p.h. The corresponding horsepowers are 24.29, 23.36, and 22.71. Under the official tractor rating codes the highest permissible rating of this tractor is 19.69 drawbar and 31.31 belt. One carburetor setting (95 per cent of maximum) was used.

Automotive Oddities—By Pete Keenan


ROBERT BIGLER OF FLINT, MICH., DRIVES A CAR EQUIPPED WITH A WEAR-O-METER.
TOP COAT
SUIT COAT
NO COAT
COLLAR OPEN
WEAR-O-METER
RIM O' THE WORLD ROAD, CLIMBING THE SAN BERNARDINO, MOUNTAIN IS ONE OF THE MOST HEAVILY TRAVELLED RECREATIONAL ROADS IN THE WORLD.
THE DURYEA CONTROL HANDLE SERVED TO OPERATE CLUTCH, STEER, BRAKES, WORK AND CONTROL THROTTLE.
FILLER & LEAKE GARAGE.
THE HORSE-AUTO, 1911. THE INVENTOR CLAIMED THE LEGS MOVED LIKE A REAL HORSE.
A SIGN IN HARRISONBURG, VA.

Write us if you know an oddity

The News Trailer

South Jersey Speed Boat Association came into possession of a "boner" trophy by gift of one of its members during a recent regatta. The first award was made by drivers, mechanics and officials at the Stone Harbor affair to a Mr. Sapp, Ventnor City, N. J., who upset his outboard racing boat by a spectacular and unnecessary turn toward shore 100 ft. after he crossed the finish line, winning a close five-mile race. He was acknowledging applause at the time.

Nash's billboard romance is over. It is said to be the first billboard "continuity." The three posters began with "love at first sight," and ended, appropriately enough, with "so proud of their first."

Twenty-three flying and engine instruments, in addition to controls, have been provided for in the design of the new twin-engined, all-metal, low-wing transport being built by Boeing.

Wonder is, how the pilot finds time to do any flying?

Zurich's Concours d'Elegance, Cannes' Grand Prix, Dieppe's Premier Grand Prix, LeTouquet's Concours d'Elegance and Portugal's International Medal all have come home to roost in the trophy cabinet of Hupp Motor Corp. Never having shown abroad in style shows, the Hupmobiles have brought pristine honor to the industry.

Here's a new one! Goodyear factory whistles sounded around the world Monday at factories in Akron, Los Angeles, Gadsden, Ala., Toronto and Bowmanville, Canada; Wolverhampton, England; Buenos Aires, Argentina, and Sydney, Australia.

All this because the 200 millionth Goodyear tire came into being, built under the six-hour day, and marked the formal acceptance by the factory of the shorter working day as a permanent policy.

Growth of the Goodyear production was indicated by the report of W. F. Floor, Goodyear statistician, that it took the company 25 1/3 years to build its first 100,000,000, and only five years to make the second 100,000,000.

NEWS

Tire Prices Up 11 to 15%

All Akron Firms Advance Prices; Ask Consumer Pay U. S. Tax

AKRON, Sept. 12—After nearly three months of disagreement and failure to unite in a common policy to boost tire and tube prices, all rubber manufacturers of the Akron area and the chief mail order houses handling automobile tires had agreed Monday on a plan to pass the Federal tax on tires and tubes on to the consumer.

The increase announced by all companies is 11 per cent on first grade tires, 14 per cent on second grade casings and 15 per cent on tubes.

This is almost identical with the increase decided upon when the Federal tax went into effect June 21 but not actually put into effect because one of the major manufacturers refused to boost his prices until mail order houses joined in the movement. Goodyear and Firestone rubber companies, and all smaller companies of the Akron area had sent out orders today to dealers putting the new prices into effect.

At the same time Sears & Roebuck Co. representatives here announced the mail order houses had agreed to the price increase and had forwarded new price schedules to their dealers and customers.

Two of the smaller rubber manufacturers, India and the Pennsylvania Co., had put the increased prices into effect earlier this month. The agreement brought the first general boost in tire prices in five years and ended a long period of price cutting that had brought automobile tire prices to the lowest figures in the history of the industry.

"Free Wheeling" Is Nobody's Trade Mark

WASHINGTON, Sept. 14—The commissioner of patents recently refused the use of "free wheeling" as a trade mark, holding that the term has become recognized as one designating a class of devices.

It is not allowable as a trade mark, it was held, under the Trade Mark Act of Feb. 20, 1905.

Wisconsin Taxes Close Car Plants

Chevrolet and Fisher Factories Unable to Face State Levies

JANESVILLE, WIS., Sept. 15—The Janesville plants of the Chevrolet Motor Co. and the Fisher Body Corp. were closed last week due to excessive taxes levied by the state of Wisconsin.

To meet these levies during the coming year alone, more than 45,000 cars would have to be built here, while present indications are that only 40,000 could be assembled under present market conditions.

"The company must, in protection of the list price of its product and the interest of its stockholders, operate in states where the tax situation is more lenient," W. S. Knudsen, president of Chevrolet, said.

"We regret the necessity of closing the Janesville plants. It is not possible to absorb the handicap which the high state taxes place on the output of the plant."

The Janesville plant supplied Chevrolet cars and trucks to dealers in Wisconsin, northern Michigan and parts of Illinois, Iowa and Minnesota.

Auto-Lite Declares Preferred Dividend

TOLEDO, OHIO, Sept. 14—Directors of the Electric Auto-Lite Co. have declared the regular quarterly dividend of $1.75 per share on preferred stock and 30 cents per share on common, the same rate as in the preceding quarter.

The payment to preferred stockholders will be $73,459.75 and to common stockholders, $278,950.20, total disbursements being $352,409.95.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, Sept. 15—Moderate reactions in security and commodity markets last week have not retarded the tendency toward improvements in business sentiment.

Ultimate consumers continued to purchase with caution, but a definite increase in wholesale activity was reported.

COTTON REACTS

The downward reaction in cotton prices followed the announcement by the Department of Agriculture that the latest estimate of the cotton crop was 11,310,000 bales. This estimate is only 4000 bales larger than that on Aug. 1, although 5,800,000 bales below that a year ago.

FAILURES SHOW DECLINE

Two encouraging signs are the decline in failures, especially bank failures, and the improvement in collections.

FREIGHT LOADINGS

Railway freight loadings during the week ended Aug. 27 showed a further improvement. The total was 537,973 cars, which marks an increase of 19,331 cars above those during the preceding week, but a decrease of 225,578 cars below those a year ago and a decrease of 446,537 cars below those two years ago.

CORPORATE EARNINGS LOW

According to the Federal Reserve Bank of New York, corporation earnings reported for the second quarter of this year showed very little net profit. More than half of the 23 groups of industrial and mercantile companies reported deficits, and the aggregate net profit for all groups was little more than one-tenth as large as that a year ago.

CONSTRUCTION IS DOWN

Construction contracts awarded in 37 Eastern States during August according to the F. W. Dodge Corporation, amounted to $133,988,100, as against $233,106,100 a year ago. Contracts awarded during July were 55 per cent below those during July of last year.

FISHER'S INDEX IS UP

Professor Fisher's index of wholesale commodity prices for the week ended Sept. 10 stood at 63.2, as against 62.5 the week before and 61.9 two weeks before. During the first week of January, this index, at 66.3, stood at the highest level for this year to date.

BANK DEBITS DOWN

Bank debits to individual accounts outside of New York City during the week ended Sept. 7 were 16 per cent below those a year ago.

FEDERAL RESERVE STATEMENT

The consolidated statement of the Federal banks for the week ended Sept. 7 showed few changes.

Holdings of Government securities and bills bought in the open market remained practically unchanged, while holdings of discounted decreased $13,000,000.

The reserve ratio on Sept. 7 was 59.2 per cent, as against 58.9 per cent for both a week and two weeks earlier.

Allows Sale of Splitdorf Assets

Court Refuses Plea of Bondholder to Restrain Trustees in Dissolution

NEWARK, N. J., Sept. 15—Trustees in dissolution of the Splitdorf Electrical Co. will not be restrained by Chancery Court from selling part of the concern's assets to the Edison-Splitdorf Corp. for $197,000, Vice Chancellor Bigelow ruled following a hearing in Jersey City of a suit brought by Robert A. Moore, a stock and bond holder.

The court decided that a temporary injunction now in effect will be modified to permit the sale.

Last month the vice chancellor refused a receivership, asked by Mr. Moore, permitting the company's own directors to dissolve it as trustees.

At that time, however, the court reserved decision as to whether the offer of the newly-formed Edison-Splitdorf Corp. for certain of the assets should be accepted. Special Master George B. Astley investigated its adequacy and recommended acceptance of the offer.

The court now has agreed, stating that all the evidence tends to prove that $197,000 is a fair offer and is more than could be obtained if the assets were liquidated in the ordinary manner.

He pointed out also that Thomas A. Edison, Inc., which had been managing the Splitdorf concern for several years, had offered through counsel to pay the claims of any creditors except bondholders.

Under the offer both stock and bond holders of the Splitdorf would receive some stock in the new concern, which was stated to have the same directorate as the old.*

The vice chancellor's memorandum further stated that 80 per cent of the bondholders and a great majority of the stockholders have approved dissolution and sale of assets.

* Page 249, Aug. 20, 1932, *Automotive Industries.*

364,401 Hold Stock In General Motors

NEW YORK, Sept. 14 — There were 364,401 holders of stock of the General Motors Corp. on the dates of record for the last dividends on common and preferred issues, compared with 359,046 in the previous quarter.

The increase of 5355 stockholders was the smallest for any quarter in more than a year. In the previous quarter the rise had been more than 13,000 stockholders, and in the quarter before that, 32,000.

On July 5 the preferred stockholders numbered 17,637 and on Aug. 13, there were 346,763 holders of common stock.

These figures compare with 17,556 and 341,490, respectively, for the second quarter of this year.

The number of stockholders for the third quarter of each year since 1917 follows:

Year	Third Quart.	Year	Third Quart.
1917	2,669	1925	68,118
1918	3,615	1926	47,805
1919	12,358	1927	57,190
1920	31,029	1928	71,682
1921	65,324	1929	140,113
1922	71,331	1930	249,175
1923	68,281	1931	293,714
1924	69,428	1932	*364,401

*Preferred stockholders of record July 5 and common stockholders of record Aug. 13.

Jacobsen Will Build Johnson Small Engines

Industrial Units Only Involved in Purchase

RACINE, WIS., Sept. 13—The Jacobsen Mfg. Co. has taken over the manufacture of small, ½ hp. air-cooled industrial engines from the Johnson Motor Co., Waukegan, Ill.

Since 1921 the Johnson Co. has built outboard motor boat engines, notably the "Johnson Sea Horse," and will continue to manufacture and sell these powerplants.

The small industrial engine division, taken over by Jacobsen, constituted only a small part of the Johnson interests.

August Studebaker, Rockne, Sales Up

SOUTH BEND, Sept. 14—Deliveries of Studebaker cars to consumers by dealers and retail branches for August this year were 30.8 per cent greater than those for the preceding month.

Deliveries of Studebaker and Rockne cars combined for August, 1932, were 17.6 per cent ahead of July and 21.9 per cent greater than the number of Studebaker cars delivered in August of last year at which time the Rockne line of cars had not been introduced.

Coated Abrasive Products Practice

WASHINGTON, Sept. 12—A recent revision of the simplified practice recommendation covering coated abrasive products has been approved by the industry to the required degree and will become effective on Oct. 1, according to an announcement by the Division of Simplified Practice of the Bureau of Standards.

The original draft of this recommendation was formulated and developed in 1928, and the present changes were proposed by a representative standing committee of the industry for the purpose of bringing the recommendation into accord with current demand.

Automotive Steel Shows Increases

Slow But Consistent Gains Noted After Labor Day Holiday

NEW YORK, Sept. 15—Having started virtually from scratch following the Labor holiday, that part of the steel industry which caters to automotive consumers is experiencing a slowly but consistently increasing demand.

Ford business accounts for the smaller part of this, so-called "experimental" orders for new model material from a widely scattered number of buyers being in the aggregate not only the relatively more important, but also the more promising.

While in some quarters there is a disposition to belittle this business as mere nibbles, the majority of steel producers hail it as the first sign of returning volume.

The turn in the monthly backlog reports of the leading interests has had a decidedly heartening effect on the industry as a whole. While the price situation continues a little changed, the market is a shade less ragged in some descriptions of finished steel.

Black sheets which are nominally quoted at 2.20 cents, Pittsburgh, but which for several months have been selling into automotive consumption at a figure nearer 2.10 cents, are still available to tonnage buyers at the latter price level, but several of the larger producers have let it be understood that they mean to restore the 2.20 cents price when it comes to fourth-quarter business.

Full-finished automobile sheets continue to be based on a 2.80 cents price, but efforts are being made to bring the spread between the price for ordinary sheets and that for automobile sheets back to a more normal level.

Ford Will Continue Building Big Planes

DETROIT, Sept. 14—Reports that the Ford Motor Co. had decided to discontinue the making of trimotor airplanes were described as "without foundation" at the Ford offices Monday.

Attention was called to the fact that the company is at work now on two such planes for a South American air line.

Gotfredson Offers Diesel Truck Now

DETROIT, Sept. 15—The Robert Gotfredson Truck Co. announces that orders are being taken for the newly developed Gotfredson-Cummins-Diesel truck in the 3, 5 and 7-ton capacities. The company recently ran tests with gasoline and Diesel powerplants in identical trucks, reporting that fuel economies greatly favored the latter.

Four-Wheel Heavy Duties

2-2½-Ton to Six-Wheel 15-Ton Jobs Offered for 1933

CLINTONVILLE, WIS., Sept. 12—The Four-Wheel Drive Auto Company has announced its line of heavy-duty trucks for 1933, which embody improvements particularly in the cabs and equipment. They range in size from the 2-2½-ton four-wheel drive to the 15-ton six-wheel drive.

The CUS road-building and snow-removal truck, of 3½-4 tons capacity, has a new cab described as of the aerodynamic type, with an internal sun visor. Its equipment includes such items as a rear-view mirror, a windshield wiper and a redesigned dash with an indirectly lighted airplane-type instruments mounted on a panel. Vents on both sides of the floor board and dual rear windows permit ample air circulation.

The engine is a six-cylinder, seven-bearing crankshaft unit of 411 cu. in. displacement and rated at 91 hp. There are five speeds forward and one reverse in the heavy-duty jaw-clutch transmission, providing a speed of 32 m.p.h. with the standard 7.35 to 1 gear ratio. Optional ratios give speeds of 19.5 to 41 m.p.h.

The standard wheelbase is 147 in. but wheelbases of 159, 169 and 179 in. are optional. The tread has been increased from 60 to 72 in., and the engine, transmission, etc., have been lowered 4 in., thus lowering the center of gravity and assuring better road-ability. The turning radius has been shortened by the increase in wheel tread.

The X6 model of 6 to 10 tons capacity is a four-wheel-drive six-wheeler, designed especially for the heavy hauls encountered in the milk and oil service. This unit is powered on the front and first rear axle. The extreme rear axle is a load-carrying member only. This permits the use of the regular FWD center differential between the driving axles to compensate for the variations in wheel travel when turning corners or traveling over rough roads. Power is supplied by a 110-hp. six-cylinder engine of 517 cu. in. displacement.

The cab is similar to that of the CU6 model. It is built along aerodynamic lines, without an external visor and is equipped with dual windshield wipers. The dash carries a unit panel in which are mounted the oil pressure gage, speedometer, ammeter, heat indicator, and switch. The dial instruments are of the airplane type with needle indicators and crowned glass faces.

Special attention is called to the brakes on this model. The service brakes are air-operated by individual diaphragms on each one of the six wheels, these diaphragms being mounted directly on the backing plates. The brake shoes are 4 in. in width and act on 17¼-in. drums, giving 912 sq. in. of braking surface. The emergency brake acts on four wheels through the driving mechanism from a 7 by 11½-in. drum located just behind the transfer case.

Rockelman Joins Continental Motors

Will Be Associated With New Development

DETROIT, Sept. 14—F. L. Rockelman today announced his resignation as president and general manager of Plymouth Motors Corp. to become associated with Continental Motors Corp. in connection with a new development, announcement of which is expected to be made in the near future.

W. R. Angell, president of Continental, said: "The association of Mr. Rockelman with Continental in the new development which we expect to announce shortly is a part of the forward looking plans which have been carefully worked out for enlarging the position of the corporation in the automotive industry."

For many years Mr. Rockelman was sales manager for the Ford Motor Co.

When Mr. Ford acquired the Detroit, Toledo and Ironton Railroad he selected Mr. Rockelman as its general manager. The rehabilitation of this road under his supervision attracted the attention of railway executives throughout the country.

When the Plymouth Motors Corp. was organized by Chrysler interests, Mr. Rockelman was selected as president.

Herrington Leaves For Iraq, Syria

A. W. Herrington, president, Marmon-Herrington Co., Inc., is leaving for Syria on Sept. 20 with Norman Nairn of the Nairn Eastern Transport Co. Mr. Herrington's trip is in connection with the new all-wheel drive truck and trailer equipment which his company has designed specially for the Iraq Petroleum Co. to be used in building a pipe line across the Syrian desert. Mr. Nairn arrived in this country Sept 10.

Simplified Practice On Grinding Wheels

WASHINGTON, Sept. 12—The proposed revision of simplified practice recommendation covering grinding wheels has been accorded the required degree of support by industry. In this, the third revision since the recommendation was formulated and developed by the industry in 1925, the tables listing standard wheels of various types are rearranged for greater convenience and new wheel sizes necessary to meet current needs were added. The revised program is to become effective on Oct. 1.

France is Good Bearings Market

All Types of Anti-Friction Bearings Being Imported

PARIS *(Special)*—France is an important market for any kind of anti-friction bearings. Although most French mechanical industries which manufacture products containing moving parts may be considered prospective purchasers of such bearings, the current demand is comparatively inactive because of the hard times, according to U. S. Consul General L. J. Keena, Paris.

At present, participation of American manufacturers in this trade is limited to certain kinds of bearings.

French statistics indicate that about 8 metric tons of American-made ball bearings and about 38 tons of roller bearings were imported into France in 1930.

In addition to the above types of American bearings, the manufacture of tapered bearings of special types, made in conformity with American designs and more or less in accordance with American manufacturing methods, has been undertaken in France by a well-established French concern.

There are no statistics covering the production of any kind of bearings in France, but French statistics show that in 1930 about 188 metric tons of ball bearings were imported.

The percentage of such imports, by countries of origin, follows: Italy, 35; Sweden, 32; Great Britain, 11; Germany, 10; United States, 4; and miscellaneous sources, 8 per cent. Corresponding figures covering a total of about 152 metric tons of roller bearings are as follows: Germany, 31 per cent; United States, 25; Sweden, 18; Great Britain, 10; other countries 16.

Sinclair Establishes City Safety Awards

NEW YORK, Sept. 14—A $10,000 prize fund to promote greater safety in driving automobiles was announced yesterday by Harry F. Sinclair, chairman of the executive committee of the Consolidated Oil Corp.

He quoted insurance statistics showing that casualities from automobile accidents in 1931 reached a total of 1,032,000 with 34,000 fatalities, and an estimated economic loss of $2,500,000 annually.

Half of the award is to be given to the municipality of more than 50,000 population which is adjudged the safest city in the United States on the basis of automobile accidents from Oct. 1, 1932, to Sept. 30, 1933; $2,500 is to be given the city of more than 50,000 having the second best record, and $2,500 to the state having the best safety record.

General Motors August Sales Show Gain Over July's Total

Consumers in U. S. Buy 37,230 Units During Month, Compared With 32,849 Cars and Trucks in Preceding Month

NEW YORK, Sept. 12—August sales of General Motors cars to consumers in the United States totalled 37,230 as against 32,849 in July and 69,876 in August a year ago.

August sales of General Motors cars to dealers in the United States totalled 24,151 as against 31,096 in July and 62,667 in August a year ago.

August sales of General Motors cars to dealers in the United States and Canada, together with shipments overseas, totalled 30,419 as against 36,872 in July and 70,078 in August a year ago.

Below is a tabulation of General Motors monthly sales for 1929, 1930, 1931 and 1932 to date. The figures are segregated to show:

1. Sales of General Motors cars to consumers in the United States;
2. Sales of General Motors cars to dealers in the United States and
3. Total sales of General Motors cars to dealers in the United States and Canada plus overseas shipments.

SALES TO CONSUMERS IN UNITED STATES

	1932	1931	1930	1929
January	47,942	61,566	74,167	73,989
February	46,855	68,976	88,742	110,148
March	46,717	101,339	123,781	166,942
April	81,573	135,663	142,004	173,201
May	63,500	122,717	131,817	169,034
June	56,987	103,303	97,318	154,437
July	32,849	85,054	80,147	147,079
August	37,230	69,876	86,426	151,722
September	.....	51,740	75,805	124,723
October	.....	49,042	57,757	114,408
November	.....	34,673	41,757	68,893
December	.....	53,588	57,989	44,216
Total	.....	937,537	1,057,710	1,498,792

SALES TO DEALERS IN UNITED STATES

	1932	1931	1930	1929
January	65,382	76,681	94,458	95,441
February	52,539	80,373	110,904	141,222
March	48,383	98,943	118,081	176,510
April	69,029	132,629	132,365	176,634
May	60,270	136,778	136,169	175,873
June	46,148	100,270	87,595	163,704
July	31,096	78,723	70,716	157,111
August	24,151	62,667	76,140	147,351
September	.....	47,895	69,901	127,220
October	.....	21,305	22,924	98,559
November	.....	23,716	48,155	39,745
December	.....	68,650	68,252	36,482
Total	.....	928,630	1,035,660	1,535,852

TOTAL SALES TO DEALERS IN U. S. AND CANADA PLUS OVERSEAS SHIPMENTS

	1932	1931	1930	1929
January	74,710	89,349	106,509	127,580
February	62,850	96,003	126,196	175,148
March	59,696	119,195	135,930	220,391
April	78,359	154,252	150,661	227,718
May	66,739	153,730	147,483	220,277
June	52,561	111,668	97,440	200,754
July	36,872	87,449	79,976	189,428
August	30,419	70,078	85,610	168,185
September	.....	58,122	78,792	146,483
October	.....	25,975	28,253	122,104
November	.....	29,359	57,257	60,977
December	.....	79,529	80,008	40,222
Total	.....	1,074,709	1,174,115	1,899,267

Dallas Retail Sales Are Up

DALLAS, TEX., Sept. 12—Figures just made public here by J. H. Connell, executive secretary of the Dallas Automotive Trades Association, show an increase of 25 per cent in automobile registrations here in August as compared with the previous month. Used car sales have maintained a steady pace during the past several months.

Massachusetts Hits Motorists With Law

Property Damage Insurance On Settlement of Claim in 60 Days, Is Now Required

By J. T. Sullivan

BOSTON, Sept. 12—Massachusetts now has on its books another new insurance law, this time designed to force motorists to carry property damage insurance. It was passed by the last legislature and went into effect last week.

Under the new law if a person has been sued for property damage, and a judgment is rendered against him, he must pay it within 60 days or he will be put off the road.

Failure to pay allows the claimant to get legal papers from the court where the case was heard showing the status of the action. These are filed with the Motor Vehicle Registrar, who makes an investigation.

If the facts are proved the registration of the owner's vehicle is taken away. Where a person carries property damage it does not apply, as payment is up to the insurance company.

Passage of this law aroused a lot of criticism early in the year. It had been laid on the table by the legislature. Within a few hours of the ending of the session it was "railroaded" through.

And now a number of candidates for office are trying to alibi themselves on this law as well as their action on the special session on compulsory insurance.

Paris Bus Co. Uses New "National Fuel"

Concerning the use of the "national fuel" (a 50-50 gasoline-alcohol mixture) in France, the Department of Commerce reports that the chief users are government departments and the Paris bus company, besides which private owners use it to a certain extent.

The mixture is being marketed to help dispose of the excess alcohol production, and it is stated that 168,000 barrels of alcohol were used in this mixture in 1930.

Germans Will Test Floating Airport

HAMBURG, GERMANY *(Special)*—Preliminary steps for establishment of a floating airport in the South Atlantic to facilitate plane service between Europe and South America have been taken by the Lufthansa Airplane Service.

The North German Lloyd steamer Westfalen has begun a three-day journey on the North Sea to test catapult and retrieving apparatus for Dornier-Wal flying boats, planning the possible establishment next year of an airport midway between Pernambuco and the West African coast.

Durant Motors Sale Postponed

No Bids Received at Auction of Lansing Plant

LANSING, MICH., Sept. 14—No bidders came forward Friday as the plant of the Durant Motors Co. here was offered for sale at auction.

The Central Trust Co., receivers for the company, set Oct. 6 as the date for a second auction.

Although the time limit for receiving bids was extended an hour and a half, no bidders were forthcoming.

More than 1000 persons attended the auction, most of them unemployed seeking work from the expected purchasers.

Reports had circulated prior to the sale that five major industrial firms were prepared to offer bids along with William C. Durant, former owner of the plant.

The plant occupies 47 acres. It recently was given a reproduction appraisal value of $2,244,260.

Pierce-Arrow Business Better During August

BUFFALO, Sept. 14—Pierce-Arrow retail deliveries for August show an increase of 60 per cent over July and of 13 per cent over August, 1931. The month's business also represents an increase over June.

"This increase," said A. J. Chanter, vice-president and manager, "is of especial significance because it indicates that the fine car market is very sensitive to the improvement in business sentiment.

"Our distributors throughout the country are optimistic," he said.

Tenney Represents Lincoln

G. E. Tenney has been appointed sales manager, Chicago district, of the Lincoln Electric Co., Cleveland.

Thompson Retires From Air Line

Founder Sells Interest to Col. Kemp, Chicago Transport Magnate

DETROIT, Sept. 13—E. G. Thompson, founder of the Thompson Aeronautical Corp., has sold his minority stock in the company to Chicago interests and has retired from the directorate.

His father, Charles E. Thompson, and Livingston Mather, Cleveland steel executive, also have retired from the company, which, it is reported, has been acquired by Col. P. G. Kemp, Chicago, organizer of Universal Airways, Inc.

The Thompson Co. operates airlines to cities in Michigan, Indiana, Illinois and Ohio and maintains amphibian service between Detroit and Cleveland.

Its operating subsidiary, Trans-American Airlines Corp., has headquarters at the Detroit Municipal Airport.

Space Economy May Revive Opposed Engines

(Continued from page 357)

sions would come at intervals of 60 deg. and 180 deg., and these spacings are so unequal that the arrangement seems undesirable. The balance, of course, also would be imperfect.

We next come to the eight-cylinder horizontal opposed engine. If we use a four-throw, single-plane crankshaft of the same type as currently employed in four-cylinder vertical engines (Fig. 6), connecting one piston in each of the two four-cylinder blocks to each crankpin, then explosions must take place in two cylinders simultaneously. From the standpoint of uniformity of torque the effect then is exactly the same as in a conventional four-cylinder engine, and the only advantage gained over the four-cylinder vertical engine, aside from that inherent in the form (the lower depth) of the horizontal engine, would be that the annoying secondary unbalanced force in the conventional four-cylinder would be done away with, and mechanical balance would be complete, except for a slight rocking couple if opposite cylinders were not coaxial.

To assure a uniform sequence of explosions it is necessary to use a two-plane crankshaft, as illustrated in Fig. 7. If opposed cylinders are in line, as there shown, secondary rocking couples are eliminated. The primary harmonics of the inertia forces produce a horizontal rocking couple, however. This could be balanced by fitting at each end of the engine, within the crankcase, a pair of geared-together, equal-sized, unbalanced gear wheels, driven at crankshaft speed.

Although none of the eight-cylinder arrangements giving an even sequence of explosions gives a perfect mechanical balance, the degree of unbalance can be made very small and practically negligible. This applies, for instance, to an arrangement equivalent to two engines of the type shown in Fig. 5, placed side by side and with the two crankshafts making an angle of 90 deg. with each other.

Twelve seems to be the minimum number of cylinders with which all of the desirable characteristics can be obtained without the use of special balancing devices. As shown in Fig. 8, the cylinders are arranged in two blocks of six, on opposite sides of the crankshaft, the latter being made of the usual six-throw type, with the throws spaced 120 deg. apart. In each block explosions occur at intervals corresponding to 120 deg. of crank motion. The two pistons connected to the same crankpin receive impulses spaced by 180 deg. of crank motion, which is 1½ times the interval between explosions in the same cylinder block. Thus explosions occur in the two blocks alternately, at uniform intervals of 60 deg. of crank motion.

As regards the balancing, it is well known that the reciprocating parts of a six-cylinder-in-line engine with six-throw, 120-deg. crankshaft are in complete balance, and the arrangement illustrated virtually constitutes two such engines joined together and using a common crankshaft. For complete mechanical balance it is thus not even necessary that opposed cylinders be coaxial.

Other advantages of the multi-cylinder horizontal opposed engine are that for a given number of cylinders the crankcase, crankshaft, camshaft, etc., are shorter and therefore lighter than in a corresponding in-line engine, and that owing to the greater stiffness of the shorter crankshaft its frequency of vibration is higher; hence, there is likely to be less trouble from torsional vibration.

With the pressure lubricating system now in almost universal use there need be no difficulty with engine lubrication. With the splash system, with which there were dippers or splashers on the connecting rod heads, as these passed through oil troughs underneath the crankshaft, they would throw a lot of oil into the cylinders toward which the crankpins moved during the lower half revolution, while the opposite bank of cylinders was starved. With pressure lubrication, oil is thrown off by the crankshaft substantially uniformly in all directions, so that all cylinders will be equally provided.

N.A.C.C. Reaffirms Opposition To Discriminatory Taxes, Waste

Singling Out Automotive Group Hit By Macauley in Plea for Strict Governmental Economy Programs

DETROIT Sept. 12 — Reaffirming their opposition to the discriminatory taxes levied against the automotive industry and its users at the last session of Congress, members of the Board of the National Automobile Chamber of Commerce, in meeting last week, renewed their demand for economy in government and the substitution of a general manufacturers' tax for the present system of selective excise taxes.

Discussing the action, Mr. Alvan Macauley, president of the Chamber, said: "The present act imposes a heavy penalty not only upon employment in a great basic industry but upon all who operate the 25,000,000 cars, trucks and buses now running over our highways.

"No system of taxation can be justified which singles out particular groups to bear more than their share of the tax load. The effect is always the same. Buying power is curtailed, employment affected and perhaps most important of all, from the viewpoint of the government, the needed tax revenues are not forthcoming.

"In times such as the present, the first emphasis should be one of rigid governmental economy. Industry has been compelled to cut its cloth to fit present-day requirements. Governments cannot be immune to the working of economic laws. Before any tax laws are enacted, the first step should be one of eliminating every cost except those which are clearly necessary or productive.

"This done, whatever new taxes are necessary should be general in character and should fall on all alike. Thus far, the most equitable levy which has been proposed is that of a manufacturers' tax which would spread the burden over all productive enterprise without discriminating against any.

"It should be noted, however, that this levy is not advocated as an addition to the present tax burden but as a substitute for the present unfair excise taxes."

Mr. Macauley said that the Chamber's position would be placed before members of Congress, industry, and the public generally, and an urgent appeal made to the law-makers to rectify the injustice imposed in the present act at the earliest opportunity.

The directors approved further conferences by the Special Committee with the Eastern Conference of Motor Vehicle Commissioners on the designing of motor cars for increased safety. It was agreed that engineers have continued to improve the safety features of automobiles; the road builders have constructed the finest type of roads, and traffic officers have marked them for safety with plenty of safety lights, but it was recognized that better results can come only with greater care on the part of drivers and more consideration of the rights of other highway users.

With full recognition of the loss to the motor industry when Roy D. Chapin became Secretary of Commerce, the directors voted him an indefinite leave of absence, as a board member, and authorized a telegram signed by all present wishing him success in this new service which he is rendering for the advancement of all business.

There was an interchange of views on present conditions and the outlook with an approval of plans for trade promotion, here and abroad. The Board authorized further research with the American Petroleum Institute, The Society of Automotive Engineers and the U. S. Bureau of Standards on improved fuels for motor vehicles.

President Alvan Macauley presided, with the following in attendance: C. W. Nash (Nash); Alfred P. Solan, Jr. (General Motors); Walter P. Chrysler (Chrysler); A. J. Brosseau (Mack); Robt. C. Graham (Graham-Paige); Chas. D. Hastings (Hupp); Bryon C. Foy (DeSoto); Wm. E. Metzger (Federal); Fred J. Haynes (Treas., N.A.C.C.); Alfred Reeves (N.A.C.C.); Pyke Johnson (N.A.C.C.); J. S. Marvin (N.A.C.C.)

Among guests at the meeting:

A. E. Barit (Hudson); W. H. Beal (Auburn); T. R. Dahl (White); L. B. Manning (Cord); B. E. Hutchinson (Chrysler); K. T. Keller (Dodge); Jos. E. Fields (Chrysler); Edw. Macauley (Packard); Jas. Wilson (Nash); LeRoy G. Peed (DeSoto); H. H. Rice.

Triples Steel Bus Body Production

LIMA, OHIO, Sept. 14—Manufacture of steel school bus bodies during the present season trebled last year's record at the Superior Body Co. here. With a limited production schedule, which began in January, the surplus stock of bodies was exhausted in May, and full-time production was resorted to in June.

AC Remodeling Its Two Plants

Machinery and Equipment Are Rearranged; New Products Being Developed

FLINT, Sept. 14—What is believed to be one of the largest revampings of factory operations ever undertaken by an automobile accessory concern is now being effected at the AC Spark Plug Co. plant here.

The project involves the relocation of machinery and equipment in both the Industrial Avenue and Dort Highway AC plants.

When it is completed the manufacturing layout of the AC company will be representative of the most efficient system in American industry.

Large pieces of equipment weighing many tons are being removed from the Industrial Avenue plant to the plant on the Dort Highway and hundreds of smaller machines are being relocated.

The new manufacturing system was planned months ago in order to keep pace with the rapid growth of the AC activities and to provide a flexible and efficient arrangement for future development.

The change of new AC models now under way and the inventory which will be taken the latter part of this month afforded the opportunity to install the new manufacturing system, which will be practically complete in about three weeks.

Completion of the "Progressive Layout," as the project is called, will mean that AC manufacturing operations will be performed in perfect sequence and more factory space will be available for new products now being developed in the AC engineering department.

"The additional manufacturing space gained through the 'Progressive Layout,'" Harlow H. Curtice, president of the AC company, said, "will be used for the manufacture of at least two important new products which we developed and which we plan to announce this fall."

Mr. Curtice also said "the new arrangement will enable our employees to accomplish their work with a minimum of effort and enjoy the benefits of a most modern manufacturing layout."

Finns Experiment With Fuel Generators on Trucks

The Finnish Government has been carrying on experiments with a gas generator operating on wood, but it is said to be still in the experimental stage. The price of the fuel is said to be only one-tenth that of gasoline, but engine power is decreased by from 15 to 20 per cent. About 30 of these generators are in operation on trucks and buses and in power mills and electric plants.

Rails Meeting Car Plant Requirements

Further Progress Reported By N.A.C.C. Traffic Men in Meeting at Detroit

DETROIT, Sept. 15—Further progress by rail lines in meeting the requirements of the automobile industry as to rates and minimum carload weights was reported at the meeting of the traffic managers, members of the National Automobile Chamber of Commerce in Detroit last week.

Favorable experience was also reported in trial shipments made in freight cars equipped with permanent devices for the upending and double-decking of automobiles. In one case, three carloads of automobiles were in a train wreck which seriously damaged other shipments without any damage to the automobiles loaded in cars equipped with permanent devices.

The railroads have also recently changed the minimum carload weights so that the use of freight cars of different lengths has been greatly facilitated.

Instead of six different sets of minima, according to the length of freight cars, there are now but two, viz.: 10,000 lb. for all freight cars up to 40 ft. 7 in. in length, with 12,500 lb. for longer cars in the East and 12,000 lb. in the West.

The meeting discussed a new basis of rates for shipments of trucks which are now included in the special tariffs recently issued on the same basis as passenger automobiles and the ratings affecting the freight charges on a number of automobile parts.

It is reported at the meeting that E. D. Grinnell, until recently Director of Traffic of the Buick Motor Co., has been appointed General Freight Agent of the St. Louis-Southwestern Ry. at St. Louis, Mo.

Factories represented at the meeting were: Auburn, Buick, Cadillac, Chevrolet, Chrysler, Dodge, General Motors Truck, Graham-Paige, Hupp, Lincoln, Nash, Packard, Olds, Rockne, K. A. Moore (N.A.C.C.), and J. S. Marvin, chairman of the conference.

Nash Promotes Larson

M. N. Larson has been appointed an assistant sales manager of the Nash Motors Co.

He has made a brilliant record as district manager for Nash in the Pacific Coast territory during the last five years and will assume his duties at the Nash plant in Kenosha immediately.

Robert T. Armstrong

Robert T. Armstrong, 61, formerly general manager of the Armstrong Spring Co., Flint, Mich., until his retirement four years ago, died in Grace Hospital Sept. 7. He had been ill since May when he underwent an operation soon after he had returned from a trip around the world.

I.H.C. Shifts Truck Sales Center to Rockford

ROCKFORD, ILL., Sept. 12—Northern Illinois and northern Indiana branches of the International Harvester Co. have been reorganized with the wholesale machinery distributing center transferred from Rockford to Aurora, Ill. The Rockford branch will become a sales point for motor trucks and transfer for retail machinery manufactured by the company.

Horace P. Howell, Rockford branch manager, has taken over the Ft. Wayne, Ind., branch and Vincent Lager, formerly at South Bend, Ind., has become Rockford manager.

The Ft. Wayne plant is a consolidation of the Richmond, South Bend and Ft. Wayne, Ind., offices.

The Rockford plant change was made necessary to provide more adequate quarters for the motor truck business, which has been steadily expanding and forced the transfer of the wholesale machinery division to Aurora.

Illinois Gas Tax Collection is Off

SPRINGFIELD, ILL., Sept. 14—The Illinois three-cent gasoline tax netted $13,705,813 during the first half of the current year, compared to $13,990,087 collected in similar period in 1931, according to Garrett D. Kinney, state director of finance.

Although the gross collections showed a decline of $284,274 over the same period a year ago, reduction in refunds paid this year, limited the net decline to $108,822.

After refunds, deductions for expenses in administering the law and other expenses, $13,244,931 was available for distribution among the various counties for road and highway improvement.

Introduce Service Station Equipment

MILWAUKEE, Sept. 15—A complete line of equipment for gasoline and oil service stations is being introduced by the Geuder, Paeschke & Frey Co., for 52 years manufacturers of metal stampings for the automotive industries, enameled ware, household utensils, etc.

L. A. Young Wire Declares 25 Cents

DETROIT, Sept. 14—L. A. Young Spring & Wire Corp., has declared a dividend of 25 cents, payable Oct. 3 to stock of record Sept. 19. A similar dividend was paid in the previous quarter.

Plan to Study World Debts

Inter-Government Obligations Under Close Scrutiny By Industrialists

NEW YORK, Sept. 12—Under the temporary chairmanship of Alfred P. Sloan, Jr., president, General Motors Corp., a group of 76 leaders in industry, agriculture and labor began today the task of mobilizing practical business opinions regarding the problem of inter-governmental debts in the light of changed economic conditions.

Acting as an "organizing unit" for what is to be known as the Committee for the consideration of Inter-governmental Debts, the group of 76 have sent invitations signed by Mr. Sloan to several thousand representative business men and farm and labor leaders throughout the country asking them to become members.

In making public the plan to form this national committee, Mr. Sloan explained its objectives as follows:

"The problem of inter-governmental debts is a problem of dollars and cents. It can be solved only by hard, straightforward business calculations. The American people cannot afford to leave a question so vital to their economic interests unsettled any longer.

"A question that involves billions of dollars directly and more billions indirectly and exercises an incalculable influence upon the welfare of our entire business life demands a solution based upon solid commercial reasoning. In its essence and in all its ramifications, the problem is a business problem and only a downright business solution will satisfy the great mass of the American people.

"There is no aspect of the problem that will not yield to ordinary processes of business thinking. Why not apply these processes? A solution reached in this way will be acceptable.

"The question to be asked by anyone who will give reasoned judgment to the problem is briefly this: What will it mean in dollars and cents to America? What will it mean in jobs, increased production, enlarged markets?

"If business reasoning decides that insistence on payment is the best course, that then is the solution we want. If reduction or even outright cancellation is the answer, that on the other hand is the answer that will be welcomed.

"Upon its wise and equitable solution will depend not only the return of prosperity and the future stability of American business, but even the welfare of the entire American nation.

"Then why not examine it in this light, with coolness and detachment? That is the viewpoint of this committee. The time has come to sit down with a pencil and paper and figure it out, to find out definitely which of the three possible solutions is best for the country."

Expects Big Change In U. S. Dealerships

Chilton Direct Mail Division Estimate Is About 110,000 Shifts

PHILADELPHIA, Sept. 15 — This year will see more than 110,000 dealer changes, according to an estimate made by the Direct Mail Division of Chilton Class Journal Co., automotive publishers.

Of these changes, increased by abnormal business conditions, more than 16,000 will represent new names added to the roster of U. S. motor vehicle dealers, and more than 22,000 will be names dropped.

The balance represents changes from one line to another, or the addition of one or more lines.

The year ending January, 1932, showed the next largest volume of changes in the industry with an estimated total of 107,000.

The Chilton list, used for direct mail work, is broken down into classifications of dealers by makes of cars, by city, and town sizes and geographical distribution.

A tabulation of the changes follows:

Year Ending	New Names	Drops	Changes
January, 1928 ...	19,156	15,010	36,349
January, 1929 ...	23,844	17,590	54,398
January, 1930 ...	25,376	18,461	49,941
January, 1931 ...	21,630	20,100	55,983
January, 1932 ...	23,070	24,571	*60,000

*Estimated.

January, 1932 ..	1,100	1,800	5,160
February, 1932 ..	1,295	1,693	4,970
March, 1932	1,550	2,106	5,275
April, 1932	1,159	1,772	4,815
May, 1932	1,445	2,010	4,794
June, 1932	1,489	2,629	5,116
July, 1932	1,182	1,481	5,003
August, 1932 ...	1,362	1,562	5,277
8 months, 1932	10,582	15,054	

New Aluminum Fluxes

Linde Air Products Company, New York, has placed on the market two new aluminum fluxes which are to replace those marketed by it in the past. Oxweld No. 1 aluminum flux is intended for welding pure aluminum, while Oxweld No. 2 aluminum flux is for welding aluminum alloys.

The new fluxes are used for welding either cast or sheet material of their respective types. In developing these fluxes, it was found more advantageous to have separate fluxes for pure aluminum and for its alloys rather than to make any distinction between castings and sheet.

These fluxes were developed by Union Carbide and Carbon Research Laboratories, Inc.

No. 1 aluminum flux, which is packed in glass jars with a new black and aluminum label, is recommended for welding the various grades of commercially pure aluminum (particularly the grades designated as 2S and 3S by the Aluminum Company of America).

No. 2 aluminum flux, packed in glass jars with blue and aluminum labels, is particularly recommended for welding the aluminum alloys, such as 17S, 51S, 43S and 4S. For shipping purposes the glass jars are carefully packed in individual stiff cardboard cartons.

Motor Wheel Passes Dividend

LANSING, MICH., Sept. 14—H. F. Harper, president of Motor Wheel Corp., in a letter to stockholders, has passed the regular dividend due at this time.

The net loss for the first six months of this year has been reported as $501,297 against a net profit for the first six months of 1931 of $211,131. Included in the net loss figure for the first half of 1932 is an amount of $256,599 for depreciation which has been charged off.

Allis-Chalmers Buys Avery S. A. Business

MILWAUKEE, Sept. 15—The Allis-Chalmers Mfg. Co., Milwaukee, has purchased the South American business of B. F. Avery & Sons, Louisville, Ky., according to an announcement by H. C. Merritt, general manager of the Allis-Chalmers tractor division here.

Charles E. Houston, for 21 years general manager of the Avery South American business, will continue to have charge of the five branches for Allis-Chalmers, situated in Buenos Aires, Rosario, Chaco, Bahia Blanca and Entre Rios, in Argentina, Paraguay and Uruguay.

Improved Sentiment Seen in Car Sales

Buying Slow But Stimulation Expected in Better Conditions

DETROIT, Sept. 12—A rather generally improved sentiment throughout the country the past month is reported by a number of sales executives of passenger car companies who have recently completed trips in various sections.

While buying still lags behind sentiment, it is felt that any general increase in business will be reflected shortly thereafter in stimulation of passenger car and truck sales.

In many instances already there has been some betterment in sales curve during the last few weeks.

Everyone of General Motors units has registered more sales during August than July. The same is reported true of Hupp and other companies.

It is generally expected now that September sales will be close to those in July as against the usual downward seasonal trend.

Bird on Visit From Japan

MILWAUKEE, Sept. 15—J. N. Bird, advertising and sales promotion manager of General Motors Japan, Ltd., Osaka, has been visiting his former home in Milwaukee on his way to England to spend some time at one of the General Motors units. He will return to Osaka, where he has been stationed three years.

+ + CALENDAR OF COMING EVENTS + +

FOREIGN SHOWS

London, Olympia Show .....Oct. 13-22
Glasgow, Scottish Motor Show..Nov. 11-19
Paris, Aeronautical Show...Nov. 18-Dec. 4

CONVENTIONS

American Society Mechanical Engineers, Cleveland, Ohio (Machine shop practice meeting) .....Sept. 12-17
American Trade Association Executives, Atlantic City (Annual) .....Sept. 15-17
Penna. Automotive Assn., Harrisburg, Pa. .....Sept. 19-20
Natl. Assoc. of Motor Bus Operators, Chicago .....Sept. 29-30
American Electric Railway Assn., Chicago, Ill. .....Sept. 27-28
Amer. Institute Mining & Met. Engrs. (Petroleum Division), Dallas, Texas .....Sept. 30-Oct. 1
National Metals Congress, Buffalo .....Oct. 3-8
S.A.E. Production Meeting, Buffalo .....Oct. 3
Amer. Society for Steel Treating, Buffalo .....October 3
Amer. Institute Mining & Met. Engrs. (Iron & Steel Division), Buffalo, N. Y. .....Oct. 3-6
National Safety Council, Washington, D. C. .....Oct. 3-7
American Welding Society, Buffalo, N. Y. .....Oct. 3-7
American Society Mechanical Engineers, Buffalo, N. Y. (Natl. Iron and Steel Meeting).....Oct. 3
S. A. E. Annual Transportation Meeting, Toronto .....Oct. 4-6
American Gas Association, Atlantic City (Annual) .....Oct. 10-14
Natl. Hardware Assn. (Accessories Branch), Atlantic City, N. J. .....Oct. 17-22
Natl. Tire Dealers Assoc., Atlanta, Ga. .....Nov. 14-16
American Society Mechanical Engineers, New York City (Annual Meeting) .....Dec. 5-9
Natl. Exposition of Power & Mechanical Engineering, New York .....Dec. 5-10
Highway & Building Congress, Detroit .....Jan. 16-23

Spectrograph Speeds Identification Of Chemical Elements in Metals

(Continued from page 359)

Since short-wave light is bent by the prism more than that of longer wave length, these images are spread out or dispersed into a band with the slit images, or lines, perpendicular to the direction of dispersion. The positions of these lines in the spectrum are definitely related to their wave lengths, so that a simple measurement of the position suffices, after proper calibration, to reveal the wave length of any given line, after which reference to standard tables then tells what particular element was its source.

The size of the spectrograph is an important consideration. Its selection depends largely on the kind of work to be done. Many attempts to use spectroscopic and spectrographic methods have been unsuccessful primarily because inadequate equipment was employed. Some elements yield relatively simple spectra, with few lines and these well separated. For them an instrument of moderate size will suffice. Others yield exceedingly complex spectra, with thousands of individual lines, separated by small wave-length intervals throughout the spectrum. When the materials to be analyzed are likely to contain considerable amounts of the latter class of elements, which include iron, chromium, manganese, nickel, cobalt, vanadium, tungsten, titanium, zirconium and many of the rarer elements, it is necessary that the spectrograph be of large size so as to spread out the spectrum to sufficient length to permit the clean separation of the lines and the finding of lines of other constituents between those of the elements mentioned.

The procedures are not difficult. Usually no elaborate chemical preparations or separations are required. While expert supervision is needed during the "breaking-in" period, the class of men that now serve as routine analysts in steel works laboratories can readily be taught to carry out the standardized procedures of spectrographic analysis.

If the samples are metallic or other electrically conducting solids, pieces of the material may often be used as electrodes and the arc or spark passed between them. Sometimes, because of the nature or form of the material, it is better to use the sample in the form of a powder or acid solution, applied in a hole bored in the end of an electrode made of pure carbon or a pure metal such as copper or silver. The photography of the spectrum differs in no essential feature from the similar operations in metallography.

When qualitative analysis will suffice, the identification of lines on the plate is made either by comparing with the spectra of known elements or by measurement of the wave lengths of the lines. Fig. 1 shows a specimen plate of the spectra of several metals with a few lines marked for identification.

Usually, however, it is necessary to know not only what is in a material but also the amounts present. For quantitative analysis the procedure is essentially the same as above with the addition that means must be provided for the measurement of line intensities. Depending upon requirements, one of the following three methods is usually employed:

1. The simplest but perhaps the least accurate method is to compare the spectrum of the sample with a series of spectra previously prepared from samples of the same kind but with various known amounts of the constituents to be determined.

2. A refinement which largely eliminates differences caused by variations in photographic material and development is to photograph the spectrum of the sample on the same plate with those of a series of standard samples. It is usually possible to find the correct value by comparison with but three standards. An example of this is found in Fig. 2 which illustrates the quantitative determination of lead in a zinc alloy.

3. The most accurate method is to compare the intensities of the lines of the constituent to be determined with lines of another constituent within the same spectrum. For this reason it is often referred to as the "Internal Standard Method." The comparison is made with photometric instruments, specially designed for the purpose. The lines to be used as reference standards must be those of a constituent present in constant or at least controllable amount in all samples. It may be the main constituent of the material as, for instance, the iron in samples of steel, or it may be an added constituent, not originally present in the material, but introduced in definite amount into all samples. The procedure is described in detail in a recent paper.[1]

Although space does not permit a discussion of accessory equipment for spectrography, it is important to know that certain attachmens are invaluable in increasing the range of usefulness of a spectrograph. Among other things we might note in passing such pieces of equipment as: the rotary sector disk, arc and spark stand, spectrum plate viewing box for uniform illumination, spectrum measuring magnifier for measuring the position of spectrum lines, etc.

Suffice it to say that the surface has only been scratched. Beyond a doubt the spectrographic method offers a remarkable tool for the factory technician. And as the research worker becomes more proficient in the use of the spectrograph he will uncover many new uses as well as the solution to otherwise baffling problems.

It seems likely that the use of this method may introduce into research the labor-saving elements so much sought for in the manufacturing plant.

ACKNOWLEDGMENT

In the preparation of this article we are indebted to Charles C. Nitchie of the Bausch & Lomb Optical Co., one of the most prominent workers in the field of applied spectrography. Complete details of the instruments made by his company as well as a complete bibliography of current literature on the subject will be found in a pamphlet, "Instruments for Spectrographic Analysis," recently published by Bausch & Lomb.

[1] "An Improved Method of Quantitative Spectrographic Analysis," by C. C. Nitchie and G. W. Standen. Industrial and Engineering Chemistry, April 15, 1932.

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

In the Navy

Speaking of suggestion systems for the factory, the U. S. Navy has formally recognized their value. According to a recent press dispatch, "Civilian employees at the Philadelphia Navy Yard and other naval stations who make suggestions which result in improvements or economy in manufacturing processes or material are to be given awards as determined by a board, the membership of which has been announced by the Secretary of the Navy."

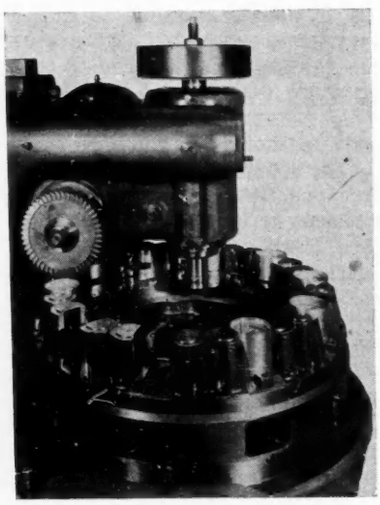


Fig. 1 shows a Sundstrand No. 3B Vertical Rotary Rigidmil with a 24 in. diam. rotary table, 26½ in. diam. table top, equipped with 12 independent interchangeable work-holding fixtures for the operation of machining the diagonal slot on aluminum pistons. Simultaneous with the machining operation a spring loaded hammer mechanism automatically stamps the word "front" on the head of the pistons as the work revolves.

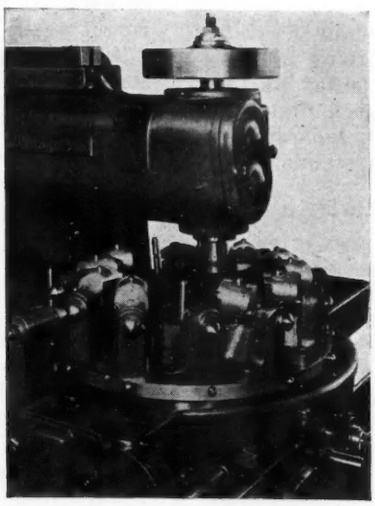
An 8 in. diam. x 3/64 in. x 1 in. high speed slitting saw having 110 teeth is used and a continuous production of 1600 pieces per hour is obtained.

Fig. 2 illustrates a Sundstrand No. 3B Rotary Rigidmil equipped with a 2-spindle head and a 24 in. diam. rotary table, also with an auxiliary drum cam unit to oscillate the table 5/16 in., timed for 10 oscillations per revolution of the table. The operation is to mill the radius at the open end of the piston and to saw a slot in the third piston ring groove. For this operation 10 independent and interchangeable fixtures are used in connection with a special two-spindle milling head.

The piston is presented to this operation with the outside diameter turned and grooved, with the head faced, the wrist pin holes bored and the diagonal slot sawed. It is loaded into the fixture with the closed end resting on steel locating plates and positioned by four steel locating plates seating on the outside diameter and by a spring clamp registering in the diagonal sawed slot. The piston is then automatically clamped by means of two cam-operated spring loaded sliding fingers gripping in the wrist pin holes.

The radius is formed in the skirt end of the piston by the cutter on the horizontal spindle and the 1/16 in. saw slot is machined by means of the cutter on the vertical spindle.

The horizontal spindle is mounted in a 6½ in. diam. eccentric quill with 5/16 in. of eccentricity. The vertical spindle is mounted in a 5 in. diam. quill and is provided with micrometer adjustment for individually setting the cutter.

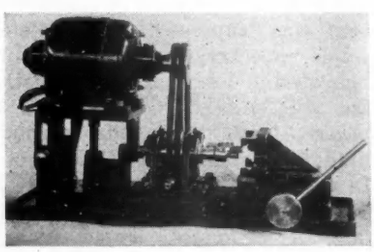


To mill the slot in the proper location in the piston it was necessary that the gash method of milling be performed, whereas to machine the radius on the skirt end of the piston it was necessary to use the continuous rotating method of milling. Therefore, by the adoption of the oscillating table as above described both methods of milling were accomplished simultaneously. The cutters are so arranged and the table is so timed that the oscillating motion takes place at the point where the radius milling cutter is between 2 pistons. Thereby the oscillating movement has no effect on the radius milling operation. The rotary table is timed to rotate 1½ revolutions per minute to obtain a production of 900 pieces per hour. The vertical spindle revolves at 760 r.p.m. and the horizontal spindle at 610 r.p.m.

Langelier 2-Spindle Finishing Machine

The two-spindle horizontal bench type machine illustrated was designed and built by the Langelier Mfg. Co., Providence, R. I., for finishing the lead bushing inserts in molded rubber covers for Ford batteries.

The spindles are mounted on ball bearings and adjustable on centers from 3¼ in. to 6 in. The drive is from a G. E. motor by two Vee-belts and grooved sheaves. The cutter heads are



equipped with a circular saw for cutting out a slug in the bottom of the bushing, and a single cutting tool ground to finish the diameter and top of the bushing as well as the boss on the top of the cover. The feed saddle carries the locating fixture and is operated by a hand lever through a rack and pinion.

The net weight of the machine is 175 lb. The bench space required is 28 in. front by 12½ in. deep, the overall height being 16 in.

Monarch Automatic Force Feed Lubrication

The Monarch Machine Tool Company, Sidney, Ohio, has just announced automatic force feed lubrication for bed, carriage, apron and compound rest as standard equipment on all Monarch lathes.

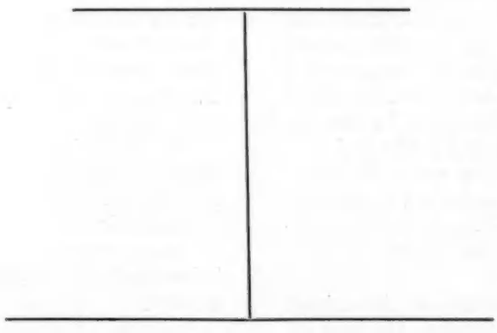
Now, Monarch lathes have only fourteen places that need occasional oiling attention—two of them require oil once a year; five require oil once a week; seven require oil two times a week.

All the major units of Monarch lathes are oiled by centralized lubrication systems. No oil cups appear on the front of the apron. All parts of the oiling system are built in and concealed. The oil sump can be quickly cleaned of any dirt or sediment.

An Announcement

Regarding a new Method of Finishing Gears after Hardening, which should be of unusual interest to gear manufacturers, will be presented in the September 24 issue of this publication. For further information, write:

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U. S. A.
or 616 Fisher Building, Detroit, Michigan



FELLOWS
GEAR SHAPERS

U. S. Leads World in Export Trade

(Continued from page 351)

that the operation of thousands of vehicles in foreign countries was being abnormally prolonged, indicated that the potential market abroad for such replacement and equipment items was excellent. The demand for the completed study was such that 80 per cent of the for-sale copies were sold within three weeks after release.

Following up the same general idea, we next turned our attention to commercial vehicles, and listed, in a bulletin to foreign field officers, all the reasons indicating why the use of such vehicles does not tend to fall off to the same extent as passenger cars during a time of depression, and that they, being "bread winners" for somebody, are the first to be replaced when conditions improve. With this information in hand field officers will be particularly vigilant to detect and promptly report upon any immediate truck business in sight and on the first evidences of any considerable replacement buying. By devoting increased attention to the parts, equipment and commercial vehicle lines, we know that this is also of direct assistance to passenger car exporters. Even though passenger car sales in some sections have been few, many car dealers overseas have been able to stay in the car business by developing efficient service and by handling a line of trucks. It of course goes without saying that the Division has left no stone unturned in its endeavor to extend the market for passenger cars.

Considerable attention is being shown in all parts of the world in commercial vehicles equipped with Diesel engines. To keep our foreign representatives on their toes in connection with this development we have gathered and sent to them in another bulletin all available information as to progress in this country. To round out the picture we are now gathering all possible up-to-the-minute data as regards Diesel developments in all other producing countries.

Following out further our automotive educational plan, we are constantly sending to field officers important data (including private publications bearing on the development of the American automotive industry), which, after thorough study, is calculated to strengthen their position with contacts in the various countries. Knowing intimately all of the background facts of the progress of the great automotive development in this country enables our officers to speak the language of the industry and adds enormously to their prestige when dealing with local automotive contacts.

Another way of focusing attention on American products in foreign countries is through the use of a very comprehensive series of educational motion picture films, privately produced with the cooperation of the Bureau of Mines, depicting, step by step, the production and workings of a great many automotive and allied products, including gasoline motors, all-steel bodies, spark plugs, lubricants, storage batteries, and the like. These are available in foreign countries subject to the approval of the firm or firms sponsoring them, and several of our foreign offices have requested copies for displaying in their territories.

Among other activities, such as keeping the industry informed of all legislation in foreign countries which is inimical to the use of motor vehicles, an important service of our offices abroad during the year was the advice given to American companies regarding the perplexing exchange problems, suitable credit terms, etc., which has been indicated as of the utmost value by our contacts in the industry. Through these services costly mistakes have been avoided and companies have been able to adopt the most sound merchandising policies during the period of business disturbances.

Without in any way relaxing its foreign trade activities, the Division is giving more and more attention to domestic commerce questions. Particularly is the Division scrutinizing and bringing to the attention of the automotive industry studies and practices of other industries which may find possible application in the motor vehicle and allied trades. This material is made available to industry through direct correspondence with firms and through trade associations and trade papers.

During the year all of the routine services of the Division, both foreign and domestic, have been materially improved. Arrangements were made to receive from each foreign office monthly automotive market surveys (to fill in the lapse between quarterly reports) and these are published in our weekly bulletin "Automotive World News."

In considering the above and other services to the industry perhaps the question of the amounts spent by the Government for these particular services arises in the mind of the reader, and since the question of economy is uppermost just now it might be well here to give an idea of the amounts spent and the conditions under which the Bureau, which is one of the Bureaus of the Department of Commerce, is now operating. The budget of the entire Bureau, which includes the Washington headquarters, all district offices in the United States, and foreign offices, is approximately 10 per cent of the budget of the Department; 1/10 of 1 per cent of the total Federal budget, and 1/37 of 1 per cent of the total government budget. It therefore follows that the Bureau, which was created to serve American industry, will spend only 1 cent out of every $10 of Federal expenditures. Rigid economies have been instituted all along the line in the Bureau, which is quite as interested in reducing expenditures as private industry.

In spite of world trade conditions and limitations brought about by the need for economy in our own organization, the Division is doing everything in its power to develop a well-rounded program of service to industry, not only as regards immediate business, but looking to the future as well.

Unquestionably export trade is as vital now as ever in the past, and the Automotive Division will continue to emphasize the important issues which face our foreign trade in automotive products.